



Nº 6357. 56

1908-09







# ENGINEERING DEPARTMENT

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FORTY-THIRD ANNUAL REPORT

OF THE

# CITY ENGINEER

BOSTON

FOR THE YEAR 1909



CITY OF BOSTON  
PRINTING DEPARTMENT

1910



*Compliments of*

Louis K. Hourke,

*Acting City Engineer.*





# ENGINEERING DEPARTMENT

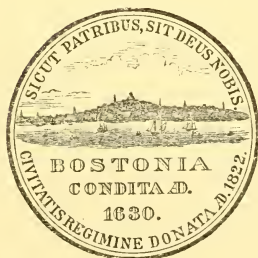
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ENGINEERING DEPARTMENT, CITY HALL,  
BOSTON, February 7, 1910.

HON. JOHN F. FITZGERALD,  
*Mayor of the City of Boston:*

SIR,—The following report of the expenses and operation of this department for the year ending January 31, 1910, is submitted.

The duties of the City Engineer include the designing and superintending of the construction of new bridges, retaining walls, city wharves and such other public engineering works as the City Council may authorize; the making of such survey plans, estimates, statements and descriptions and taking such levels as the city government or any of its departments or committees may require; the custody of all surveys and plans relating to the laying out, locating anew, altering, widening or discontinuing of streets, and the new engineering construction for all departments of the city. He shall be consulted on all work where the advice of a civil engineer would be of service. The office of the City Engineer was established by ordinance on October 31, 1850, and by chapter 449 of the Acts of 1895.

The following is a statement of engineering expenses from February 1, 1909, to January 31, 1910:

Amount of department appropriation for 1909-10,	\$84,000 00
Amount expended for 1909-10 . . . . .	83,950 45
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Unexpended balance . . . . .	<u>\$49 55</u>

# STATEMENT OF EXPENDITURES, DEPARTMENT APPROPRIATION.

(As per Auditor's Report, page 63.)

Salaries:	
Engineer, William Jackson . . . . .	\$6,000 00
Assistant engineers, draughtsmen and assistants . . . . .	69,824 29
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	\$75,824 29
Automobile . . . . .	\$1,600 00
Repairs, supplies and storage . . . . .	751 11
	<hr/>
	2,351 11
Traveling expenses . . . . .	1,217 14
Instruments, tools and repairs . . . . .	1,026 99
Printing . . . . .	612 06
Telephone service . . . . .	571 98
Blueprinting and photographing . . . . .	566 03
Horse-keeping . . . . .	450 75
Stationery . . . . .	343 30
Books and papers . . . . .	315 58
Washing and small supplies . . . . .	177 86
Expert services . . . . .	147 00
Binding and plans . . . . .	122 08
Furniture and office expenses . . . . .	99 60
Postage . . . . .	60 20
Typewriting . . . . .	35 28
Messenger service . . . . .	29 20
	<hr/>
	<u>\$83,950 45</u>

## ABOLISHMENT OF GRADE CROSSINGS.

### *Dorchester Avenue.*

Expenditures from February 1, 1909, to January 31, 1910:

Items of expenditure:

Land-taking . . . . .	\$1,175 00
Expended previous to 1909 . . . . .	1,056,107 27
	<hr/>
	<u>\$1,057,282 27</u>

*East Boston.*

Expenditures from February 1, 1909, to January 31, 1910:

Items of expenditure:

Land damages . . . . .	\$6,091 15
Expert services . . . . .	2,067 50
Relocating water pipes . . . . .	1,492 81
Personal damages . . . . .	1,094 58

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 \$10,746 04

Expended previous to 1909 . . . . . 375,225 12

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 \$385,971 16
*Freeport, Walnut and other Streets.*

Expenditures from February 1, 1909, to January 31, 1910:

Items of expenditure:

Land damages . . . . .	\$2,000 00
Photographs of buildings . . . . .	96 00
Copying records . . . . .	2 63

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 \$2,098 63

Expended previous to 1909 . . . . . 35,855 50

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 \$37,954 13

## CHELSEA STREET BRIDGE.

Appropriation and revenue . . . \$75,018 00

Less amount transferred to Park

Department May 20, 1909 . . . 20,000 00

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 \$55,018 00

Expenditures from February 1, 1909, to January 31, 1910:

Items of expenditure:

Draw span . . . . .	\$16,155 43
Draw foundation, etc. . . . .	7,767 13
Engineering . . . . .	5,076 84
Draw machinery . . . . .	3,240 79
East Boston approach . . . . .	1,737 00
Inspection . . . . .	1,238 52
Abutment . . . . .	667 00
Gates . . . . .	552 50
Drawtenders' house . . . . .	535 50
Printing . . . . .	79 86
Advertising . . . . .	77 17

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 \$37,127 74

Expended previous to 1909 . . . 10,295 22

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 47,422 96

Unexpended balance February 1, 1910 . . . \$7,595 04

## CONGRESS STREET BRIDGE.

Appropriation . . . . .	\$35,000 00
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Expenditures from February 1, 1909, to January 31, 1910:

Items of expenditure:

Rebuilding bridge . . . . .	\$11,727 65
Draw fender pier . . . . .	3,944 79
Draw machinery . . . . .	1,006 39
Draw repairs . . . . .	989 00
Temporary bridge . . . . .	546 34
Engineering . . . . .	145 00
Inspection . . . . .	66 50
Printing . . . . .	39 20
Advertising . . . . .	37 17
Drawtenders' house . . . . .	35 22

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\$18,537 26

Expended previous to 1909 . . . . .	10,208 31
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28,745 57

Unexpended balance February 1, 1910 . . . . .	\$6,254 43
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## HUNTINGTON AVENUE BRIDGE.

Appropriation . . . . .	\$55,000 00
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Expenditures from February 1, 1909, to January 31, 1910:

Items of expenditure:

Rebuilding bridge . . . . .	\$47,802 45
Engineering . . . . .	2,756 29
Inspection . . . . .	698 60
Paving . . . . .	681 85
Printing . . . . .	57 49
Advertising . . . . .	33 08

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\$52,029 76

Expended previous to 1909 . . . . .	417 74
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52,447 50

Unexpended balance February 1, 1910 . . . . .	\$2,552 50
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## MASSACHUSETTS AVENUE BRIDGE.

Appropriation . . . . .	\$40,000 00
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Less amount transferred to Park

Department, May 20, 1909 . . . . .	10,000 00
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\$30,000 00

Carried forward . . . . .	\$30,000 00
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<i>Brought forward</i> . . . . .		\$30,000 00
Expenditures from February 1, 1909, to January 31, 1910:		
Items of expenditure:		
Rebuilding bridge . . . . .	\$4,447 26	
Paving . . . . .	2,089 83	
Relocating water pipes . . . . .	913 29	
Engineering . . . . .	110 24	
Advertising . . . . .	6 50	
	<hr/>	
	\$7,567 12	
Expended previous to 1909 . . . . .	20,492 70	
	<hr/>	
		28,059 82
		<hr/>
Unexpended balance February 1, 1910 . . . . .		<u>\$1,940 18</u>

## NORTHERN AVENUE AND SLEEPER STREET.

Expenditures from February 1, 1909, to January 31, 1910:

Items of expenditure:		
Paving, fences, etc. . . . .	\$35,828 69	
Sea wall at docks 2 and 3 . . . . .	11,408 93	
Engineering . . . . .	4,485 82	
Draw machinery . . . . .	3,112 46	
Inspection . . . . .	1,472 04	
Draw span . . . . .	867 04	
Rent of office . . . . .	373 09	
Printing . . . . .	69 27	
Drawtenders' house . . . . .	68 20	
Telephone . . . . .	59 62	
Advertising . . . . .	32 20	
Piers and abutment . . . . .	27 60	
	<hr/>	
	\$57,804 96	
Expended previous to 1909 . . . . .	762,179 69	
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		<u>\$819,984 65</u>

## BRIDGES.

The annual inspection of all highway and footbridges has been made, together with special examinations when notified by the Street Department of the progress of repairs.

The management of all the bridges and draws between Cambridge and Boston, by the Acts of 1898, chapter 467, is vested in a board of two commissioners, which has charge of the following seven bridges, viz.: Brookline Street, Cambridge, Cambridge Street, Harvard, North Harvard Street, Prison Point and Western Avenue to

Cambridge; one-half the cost of the maintenance of these bridges is paid by each of these cities.

Mt. Washington Avenue Bridge has been removed during the year and the new bridge at the Charles River Dam was opened to travel January 27, 1910.

In the list of bridges those marked with a star (\*) are over navigable waters, and are each provided with a draw, the openings of which are shown in a table in Appendix A.

#### I.— BRIDGES WHOLLY SUPPORTED BY BOSTON.

Agassiz road, in the Fens.

Allston Bridge, over Boston & Albany R. R., Brighton.

Arborway Bridge, in Arborway, over Stony brook.

Ashland street, over Providence Division, N. Y., N. H. & H. R. R., West Roxbury.

Athens street, over Midland Division, N. Y., N. H. & H. R. R.

\* Atlantic avenue, over Fort Point channel.

Audubon road, over Boston & Albany R. R.

Baker street, at Brook Farm, West Roxbury.

Beacon street, over outlet to the Fens.

Beacon street, over Boston & Albany R. R.

Bennington street, over Boston, Revere Beach & Lynn R. R., East Boston.

Berkeley street, over Boston & Albany R. R.

Bernier Street Footbridge in the Riverway.

Berwick Park Footbridge, over Providence Division, N. Y., N. H. & H. R. R.

Blakemore street, over Providence Division, N. Y., N. H. & H. R. R., West Roxbury.

Bolton street, over Midland Division, N. Y., N. H. & H. R. R.

Boylston street, in the Fens.

Boylston street, over Boston & Albany R. R.

Bridle path, over Muddy river, in the Riverway.

Broadway, over Boston & Albany R. R.

\* Broadway, over Fort Point channel.

Brookline avenue, over Boston & Albany R. R.

Brooks street, over Brooks street, Brighton.

Byron street, over Boston, Revere Beach & Lynn R. R.

\* Castle Island Footbridge, from Marine Park, South Boston, to Castle Island.

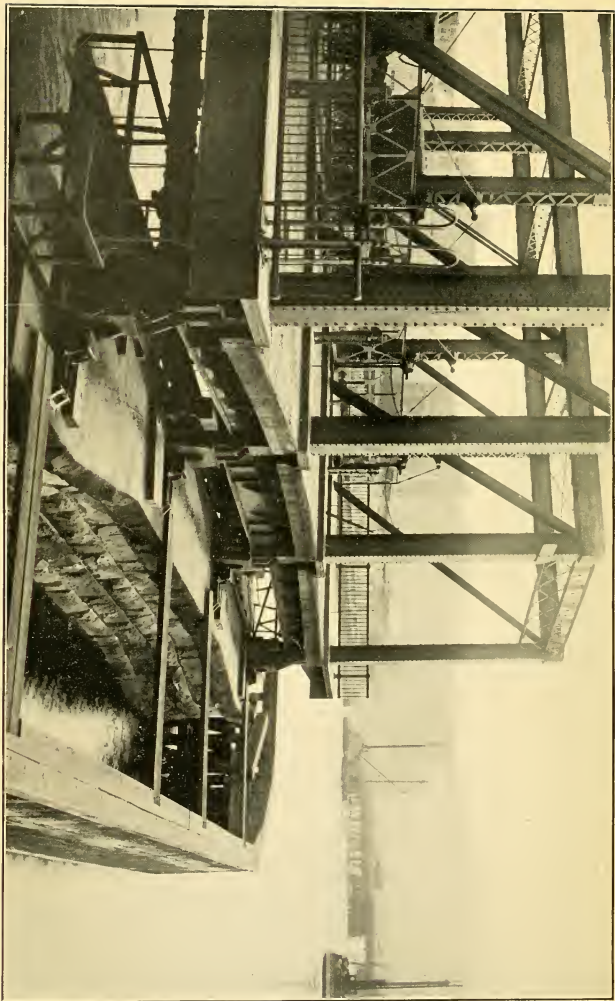
Charlesgate, over Boston & Albany R. R., in the Fens.

Charlesgate, over Ipswich street, in the Fens.





NORTHERN AVENUE BRIDGE. BIRD'S-EYE VIEW LOOKING SOUTH.



NORTHERN AVENUE BRIDGE. DRAW LANDING.

- \* Charlestown Bridge, from Boston to Charlestown.
- \* Chelsea Bridge South, over South channel, Mystic river.
- \* Chelsea street, from East Boston to Chelsea.
- Circuit drive, over Scarboro' pond, in Franklin Park.
- Columbia road, over Old Colony Division, N. Y., N. H. & H. R. R.
- Columbia road, over Shoreham street.
- Columbus avenue, over Boston & Albany R. R.
- \* Commercial point, or Tenean, Dorchester.
- Commonwealth avenue, in the Fens.
- \* Congress street, over Fort Point channel.
- Cottage Farm Bridge, over Boston & Albany R. R., Brighton.
- Cottage Street Footbridge, over flats, East Boston.
- Dartmouth street, over Boston & Albany R. R. and Providence Division, N. Y., N. H. & H. R. R.
- \* Dorchester avenue, over Fort Point channel.
- \* Dover street, over Fort Point channel.
- Ellicott arch, in Franklin Park.
- Fen Bridge, in the Fens.
- Ferdinand street, over Boston & Albany R. R.
- Florence street, over Stony brook.
- Forest Hills entrance, in Franklin Park.
- Gainsborough Street Footbridge, over Providence Division, N. Y., N. H. & H. R. R.
- Gold street, over Midland Division, N. Y., N. H. & H. R. R.
- Huntington avenue, over Boston & Albany R. R.
- Hyde Park avenue, over Stony brook.
- Ipswich street, over waterway, in the Fens.
- Irrington Street Footbridge, over Providence Division, N. Y., N. H. & H. R. R.
- \* L street, over Reserved channel, South Boston.
- Leverett Pond Footbridge, in Leverett Park.
- \* Malden Bridge, from Charlestown to Everett.
- Massachusetts avenue, over Boston & Albany R. R.
- Massachusetts avenue, over Providence Division, N. Y., N. H. & H. R. R.
- \* Meridian street, from East Boston to Chelsea.
- Neptune road, over Boston, Revere Beach & Lynn R. R.
- Newton street, over Providence Division, N. Y., N. H. & H. R. R.
- \* Northern avenue, over Fort Point channel.
- Public Garden Footbridge.
- Scarboro Pond Footbridge, in Franklin Park.

Shawmut avenue, over Boston & Albany R. R. and Providence Division, N. Y., N. H. & H. R. R.

Southampton street, east of Midland Division, N. Y., N. H. & H. R. R.

Summer street, over A street, South Boston.

Summer street, over B street, South Boston.

Summer street, over C street, South Boston.

\* Summer street, over Fort Point channel.

\* Warren Bridge, Boston to Charlestown.

West Rutland Square Footbridge, over Providence Division, N. Y., N. H. & H. R. R.

Winthrop Bridge, from Breed's Island to Winthrop.

Wood Island Park Footbridge, over Boston, Revere Beach & Lynn R. R.

## II.— BRIDGES OF WHICH BOSTON SUPPORTS THE PART WITHIN ITS LIMITS.

Bellevue street, over Muddy river, in the Riverway.

Bernier Street Footbridge, over Muddy river, in the Riverway.

Brookline avenue, over Muddy river, in the Riverway.

Central avenue, from Dorchester to Milton.

\* Chelsea Bridge North, over North channel, Mystic river.

\* Granite Bridge, from Dorchester to Milton.

Huntington avenue, over Muddy river, in the Riverway.

Longwood avenue, over Muddy river, in the Riverway, and over Boston & Albany R. R.

Milton Bridge, from Dorchester to Milton.

\* Neponset Bridge, from Dorchester to Quincy.

\* North Beacon street, from Brighton to Watertown.

Spring street, from West Roxbury to Dedham.

\* Western avenue, from Brighton to Watertown.

## III.— BRIDGES OF WHICH BOSTON PAYS A PART OF THE COST OF MAINTENANCE.

Albany street, over Boston & Albany R. R. freight tracks.

Ashmont street and Dorchester avenue, over Old Colony Division, N. Y., N. H. & H. R. R.

Austin street, over Boston & Maine R. R., Charlestown.

Bennington street, over Boston & Albany R. R., East Boston.

- Blue Hill avenue, over Midland Division, N. Y., N. H. & H. R. R., Mattapan.
- Boston street, over Old Colony Division, N. Y., N. H. & H. R. R.
- Brookline street, over Boston & Albany R. R.
- Brookline street, from Brighton to Cambridge.
- Cambridge Bridge, from Boston to Cambridge.
- \* Cambridge street, from Brighton to Cambridge.
- Cambridge street, over Boston & Maine and Boston & Albany Railroads.
- Chelsea Bridge, over Boston & Maine R. R., Charlestown.
- Curtis street, over Boston & Albany R. R., East Boston.
- Dorchester avenue, over Old Colony Division, N. Y., N. H. & H. R. R.
- Everett street, over Boston & Albany R. R., Brighton.
- \* Harvard Bridge, from Boston to Cambridge.
- Harvard street, over Midland Division, N. Y., N. H. & H. R. R., Dorchester.
- Maverick street, over Boston & Albany R. R., East Boston.
- Norfolk street, over Midland Division, N. Y., N. H. & H. R. R., near Dorchester station.
- Norfolk street, over Midland Division, N. Y., N. H. & H. R. R., near Blue Hill avenue station.
- \* North Harvard street, from Brighton to Cambridge.
- Oakland street, over Midland Division, N. Y., N. H. & H. R. R., Mattapan.
- Perkins street, over Boston & Maine and Boston & Albany Railroads, Charlestown.
- Porter street, over Boston & Albany R. R., East Boston.
- Prescott street, over Boston & Albany R. R., East Boston.
- \* Prison Point Bridge, Charlestown to Cambridge.
- Saratoga street, over Boston & Albany R. R., East Boston.
- Southampton street, over Old Colony Division, N. Y., N. H. & H. R. R.
- Summer street, over freight tracks, N. Y., N. H. & H. R. R.
- Sumner street, over Boston & Albany R. R., East Boston.
- Webster Street Footbridge, over Boston & Albany R. R., East Boston.
- West Fourth street, over Old Colony Division, N. Y., N. H. & H. R. R., South Boston.
- \* Western avenue, from Brighton to Cambridge.

## IV.—BRIDGES SUPPORTED BY RAILROAD CORPORATIONS.

*1st.—Boston & Albany R. R.*

Albany street, over passenger tracks.

Harrison avenue.

Market street, Brighton.

Tremont street.

Washington street.

*2d.—Boston & Maine and Boston & Albany Railroads.*

Main street, Charlestown.

Mystic avenue, Charlestown.

*3d.—Boston & Maine R. R., Eastern Division.*

Wauwatosa avenue, East Boston.

*4th.—Boston, Revere Beach & Lynn R. R.*

Everett street, East Boston.

*5th.—New York, New Haven & Hartford R. R., Midland Division.*

Broadway.

Dorchester avenue.

Fifth street.

Fourth street.

Morton street, Dorchester.

Second street.

Silver street.

Sixth street.

Third street.

Washington street, Dorchester.

*6th.—New York, New Haven & Hartford R. R., Old Colony Division.*

Adams street.

Cedar Grove Cemetery.

Freeport street.

Medway street.

Savin Hill avenue.

*7th.—New York, New Haven & Hartford R. R., Providence Division.*

Albany street.

Baker street, West Roxbury.

Beech street, West Roxbury.

Bellevue street, West Roxbury.

Berkeley street.  
 Broadway.  
 Canterbury street, West Roxbury.  
 Castle square.  
 Centre and Mt. Vernon streets, West Roxbury.  
 Columbus avenue.  
 Dartmouth street.  
 Gardner street, West Roxbury.  
 Harrison avenue.  
 Park street, West Roxbury.  
 Walworth street, West Roxbury.  
 Washington street.

#### V.—BRIDGE SUPPORTED BY THE METROPOLITAN PARK COMMISSION.

Mattapan Bridge, Dorchester to Milton.

#### VI.—BRIDGES SUPPORTED BY THE CHARLES RIVER BASIN COMMISSION.

\* Charles River Dam Bridge.

\* Craigie temporary bridge.

#### RECAPITULATION OF BRIDGES.

I.	Number wholly supported by Boston . . .	74
II.	Number of which Boston supports that part within its limits . . . . .	13
III.	Number of which Boston pays a part of the cost of maintenance . . . . .	33
IV.	Number supported by railroad corporations:	
	1. Boston & Albany R. R. . . . .	5
	2. Boston & Maine and Boston & Albany Railroads . . . . .	2
	3. Boston & Maine R. R., Eastern Div., . . . . .	1
	4. Boston, Revere Beach & Lynn R. R., . . . . .	1
	5. N. Y., N. H. & H. R. R., Midland Div., . . . . .	10
	6. N. Y., N. H. & H. R. R., Old Colony Div. . . . .	5
	7. N. Y., N. H. & H. R. R., Providence Div. . . . .	16
V.	Number supported by the Metropolitan Park Commission . . . . .	1
VI.	Number supported by Charles River Basin Commission . . . . .	2
	Total . . . . .	<u>163</u>



*Agassiz Road Bridge (in the Fens).*

This bridge was built in 1887 of brick and stone masonry. It is maintained by the Park Department and is in good condition.

*Albany Street Bridge (over the Boston & Albany R. R. Freight Tracks).*

The original structure was built in 1856-57, and rebuilt in 1867-68. The present bridge was built in 1886-87, and is maintained in part by the City of Boston and in part by the Boston & Albany R. R. An examination of this bridge made in August, 1909, showed that the floor beams, including connections, and the lower chords were in such condition as to be unsafe for a load covering the full width of the roadway. On recommendation of this department team travel was restricted to two roadways, each about 10 feet wide, adjoining the curb lines, a portion in the center of the roadway about 7 feet in width being thrown out of service. Plans are now in preparation for rebuilding the bridge this year.

*Allston Bridge (over the Boston & Albany R. R., Brighton).*

This is an iron bridge, built in 1892. The sidewalks have been rebuilt during the year. The ironwork above the floor should be painted this year.

*Arborway Bridge (over Stony Brook, in Arborway near Forest Hills Station).*

This is a wooden bridge resting on abutments of vulcanized spruce piles. The stringers and underplanking are of vulcanized hard pine. When this bridge was built in 1893 it was assumed that within ten years the channel of Stony brook would be improved at this point, and a temporary structure was all that was deemed necessary. The piles and some of the stringers are badly decayed and unless a permanent structure is to be built at once the bridge should be rebuilt within the next two years. The bridge is maintained by the Park Department.

*Ashland Street Bridge (over Providence Division, New York, New Haven & Hartford R. R., West Roxbury).*

The present structure is of iron and was built in 1875. With the exception of one of the fences the bridge is in fair condition.



*Ashmont Street and Dorchester Avenue Bridge (over Old Colony Division, New York, New Haven & Hartford R. R.).*

This is a wooden bridge formerly maintained by the railroad company. It was lengthened on the Boston side in 1895, and now the city maintains 75 feet of the northerly part. The deck and sidewalk planking have been patched. The deck planking and some stringers should be renewed. The bridge will soon be extended on the city side. (See page 46.)

*Athens Street Bridge (over Midland Division, New York, New Haven & Hartford R. R.).*

This is an iron bridge, built in 1874. The sidewalks and deck planking should be renewed and the bridge should be painted.

*Atlantic Avenue Bridge (over South Terminal Station Yard and Fort Point Channel).*

The bridge was completed and opened to travel August 12, 1907. On the Boston approach is a steel viaduct about 450 feet in length, consisting of a series of short plate girder and I-beam spans of the deck type. The bridge over the railroad yard consists of two steel plate girder spans and two steel truss spans, all except one plate girder span being through spans. Fort Point channel is crossed by one truss span, a plate girder span, an I-beam span and a draw span, all being deck structures built of steel. The draw span is a swing or turntable draw, 184 feet long on center line, operated by electricity and compressed air. On the approaches and across Fort Point channel the bridge is 50 feet in width; over the railroad yard the width is 60 feet. Some painting should be done this year, otherwise the bridge is in good condition. (See page 88, Appendix G.)

*Audubon Road Bridge (over the Boston & Albany R. R.).*

This is a steel plate girder bridge, built in 1893-94, and is maintained by the Park Department. A new flooring for the roadway has been built during the year and new sidewalk planking laid. It was not deemed necessary to put in new stringers, although some of them were soft on upper edges. The top flanges of girders only were painted but the bridge, especially over main tracks, should be cleaned and painted this year.

*Austin Street Bridge (over Boston & Maine R. R., Charlestown).*

This is a steel plate girder deck bridge with steel floor beams supporting a wooden flooring, built under the decree of the Superior Court abolishing the Austin street grade crossing. It was built in 1903-07 by the Boston & Maine Railroad Company and is over the railroad location. The bridge has fourteen spans resting on stone piers; it is 50 feet wide and has one 10-foot plank sidewalk and a roadway 39 feet wide, paved with stone blocks. Part of this bridge was opened to travel May 6, 1903, being connected to the Cambridge end by temporary structures. The entire bridge was opened to travel September 17, 1907. The surface of the bridge is maintained by the city, the remainder by the railroad company. The fences should be repaired and painted; otherwise the bridge is in good condition.

*Baker Street Bridge (at Brook Farm, West Roxbury).*

This is a wooden stringer bridge of about 15 feet span. It is in fair condition.

*Beacon Street Bridge (over Outlet of the Fens).*

This bridge was built in 1880-81, and had up to 1901 a wooden floor for the roadway. At the latter date a new floor was built, consisting of 18-inch steel I-beams incased in Portland cement concrete, and the roadway was paved with hard pine blocks, treated by the creoresinate process. New sidewalks have been laid during the year and some painting done. The bridge is in good condition.

*Beacon Street Bridge (over Boston & Albany R. R.).*

This is an iron bridge, built in 1884-85, widened in 1887-88, and the central roadway further widened in 1890 for the convenience and at the expense of the street railway company. During the year the two side roadways have been rebuilt, new stringers put in where necessary and new planking for both courses put in; new sidewalks have been laid and the ironwork below the flooring has been cleaned and painted. Within a few weeks the Boston Elevated Railway Company will rebuild the flooring of the middle roadway which carries both of its tracks. When this work is completed the bridge will be in good condition, excepting the ironwork above the floor which should be painted this season or early next.

*Bellevue Street Bridge (over Muddy River, in Riverway).*

This is a segmental masonry arch of 44 feet span and 15 feet rise. It was built in 1893 by the park departments of Boston and Brookline and is maintained jointly by them.

*Bennington Street Bridge (over Boston & Albany R. R., East Boston).*

This is a steel plate girder bridge built by the railroad company in 1906 under the decree of the Superior Court abolishing the grade crossings in East Boston. The surface of the bridge is maintained by the city and the rest of the structure by the railroad company. The bridge should be painted, otherwise it is in good condition.

*Bennington Street Bridge (over Boston, Revere Beach & Lynn R. R.).*

This bridge is made up of two independent parts; the old part is of iron, built in 1889; the new part is of steel, built in 1902. The intown roadway has been replanked and a small amount of painting has been done. The bridge should be painted, and the out of town roadway will soon need redecking. Otherwise the bridge is in good condition.

*Berkeley Street Bridge (over Boston & Albany R. R. and Providence Division, New York, New Haven & Hartford R. R.).*

The bridge over the tracks of the Boston & Albany R. R., which is maintained by the city, was originally built for the Boston Water Power Company, and accepted by the city in 1869. The present structure over these tracks is a through plate girder bridge and was built in 1891.

The bridge over the tracks of the N. Y., N. H. & H. R. R. was built in 1899 and is maintained by that company. Work is now in progress under a contract with the Boston Bridge Works for repairing and strengthening the bridges over both railroads, the Boston Elevated Railway Company joining with the city in this work. The work will be completed early in the spring.

*Bernier Street Footbridge (over Bridle Path, in Riverway).*

This is a semicircular masonry arch of 38 feet 4 inches span. It was built in 1893 and is maintained by the Park Department.

*Bernier Street Footbridge (over Muddy River).*

This is a segmental masonry arch of 52 feet span and 14 feet rise. It was built in 1893 by the park departments of Boston and Brookline and is maintained jointly by them.

*Berwick Park Footbridge (over Providence Division, New York, New Haven & Hartford R. R.).*

This is an iron footbridge, erected in 1894. The iron stairs and piers were new, but the trusses and floor beams were those built for Franklin street in 1883. New treads have been put on all the stairways during the year and the bridge is in good condition.

*Blakemore Street Bridge (over Providence Division, New York, New Haven & Hartford R. R.).*

This is an iron bridge, built in 1881-82. The railings and the trusses above the floor have been painted the past year. The lower planking is poor and should be renewed and the ironwork below floor painted.

*Blue Hill Avenue Bridge (over Midland Division, New York, New Haven & Hartford R. R.).*

This is a steel bridge, built by the N. Y., N. H. & H. R. R. in 1903 and is over the railroad location. The surface of the bridge is maintained by the city, the remainder by the railroad company. The steel work has been painted and the bridge is in good condition, excepting the sidewalk planking, which should be renewed.

*Bolton Street Bridge (over Midland Division, New York, New Haven & Hartford R. R.).*

This is a wooden bridge, originally built in 1889 and rebuilt in 1905. The deck planking needs renewal.

*Boston Street Bridge (over Old Colony Division, New York, New Haven & Hartford R. R.).*

This is a plate girder bridge, built in 1900 in connection with the abolishment of the grade crossing on Dorchester avenue. The surface of the bridge is maintained by the city and the rest of the structure by the railroad company. The south sidewalk and the boxing around the girders need repairing, and the bridge should be painted. The deck planking should be renewed within two years.

*Boylston Street Arch Bridge (in the Fens).*

This is a stone arch bridge, built in 1881. It is in good condition, with the exception of coping, which should be repointed without further delay.

*Boylston Street Bridge (over Boston & Albany R. R.).*

The first bridge on this location was built in 1886-88 and the present structure in 1907-08. A full description of the new bridge was given in last year's report.

*Bridle Path Bridge (over Muddy River, in the Riverway).*

This is a masonry bridge of three arches; the central arch is elliptical in form, with a span of 30 feet and a rise of 9 feet 6 inches; the side arches are semicircular, 15 feet in diameter. It was built in 1894 and is maintained by the Park Department. It is in good condition.

*Broadway Bridge (over Fort Point Channel).*

The draw was built in 1874-75 and the supports for the draw landings are iron columns. The rest of the bridge is built of steel on masonry piers, and was rebuilt in 1901-04. The steel work over Foundry street, the plate girder section over the railroad, the gates and some of the fencing should be painted. The tracks and wheels below the draw are in poor condition. The stone piers should be repointed. The planking on the draw should be renewed and the planking on the waterway and pier needs repairing. The draw is old and too light for heavy travel and should be rebuilt within two years. The main bridge is in good condition except the painting.

*Broadway Bridge (over Boston & Albany R. R.).*

The old bridge, built in 1880-81, was replaced in 1900 by the present bridge. The examinations which have been made from ladders of the under side of this bridge show that the steel is badly corroded. The flooring should be stripped off, the steel work thoroughly cleaned and painted; while this is being done an opportunity will be afforded for a more careful examination to be made than is now possible, which may reveal conditions requiring more extensive repairs. It is recommended that this work be done early this year.

*Brookline Avenue Bridge (over Boston & Albany R. R.).*

This is an iron bridge, built in 1884. With the exception of the paint the bridge is in fair condition; it should be painted next year at the latest.

*Brookline Avenue Bridge (over Muddy River, in the Riverway).*

This is a semicircular masonry arch of 15 feet span. It was built in 1892 by the park departments of Boston and Brookline and is maintained by them jointly.

*Brookline Street Bridge (from Brighton to Cambridge).*

This is a wooden trestle bridge, built on a pile foundation in 1906, and is in care of the Commissioners for Boston and Cambridge Bridges; the city pays one-half the cost of maintenance. It was built as a temporary structure, with the expectation that it would be replaced by a permanent bridge within ten years. As the bridge is now three years old the construction of the permanent bridge should be commenced within a year or two. Additional scuppers are needed at both ends of the bridge. It is in good condition.

*Brookline Street Bridge (over Boston & Albany R. R.).*

This is a steel plate girder bridge, on steel trestles, with wooden floor and wearing surface, built in 1906. The surface of the bridge is maintained by the city and the rest of the structure by the railroad company. It is in good condition.

*Brooks Street Bridge (near Faneuil Station, Brighton).*

This is a steel bridge with a concrete and asphalt floor, built in 1902. The bridge should be painted and the roadway surface should be repaired.

*Byron Street Bridge (over Boston, Revere Beach & Lynn R. R.).*

This is a wooden bridge, built in 1889. The stringers and bulkheads are in poor condition and the bridge needs a general overhauling.

*Cambridge Bridge (from Boston to Cambridge).*

The new bridge was completed in the fall of 1907, the formal dedication having taken place July 31.



Since December 21, 1907, the bridge has been maintained by the Commissioners for the Boston and Cambridge Bridges, and the city pays one-half of the cost of maintenance. The structure is in good condition and needs only the yearly cleaning and customary touching up of the paint, which has been made unsightly in spots on account of the seepage of water. It is of the utmost importance that this bridge should be kept properly painted in order that it may not be deteriorated by rust.

*Cambridge Street Bridge (from Brighton to Cambridge).*

This is a wooden pile bridge with a wooden leaf draw. The Boston end was rebuilt in 1884. The draw sidewalk on Boston end and the Cambridge end of the bridge were rebuilt in 1890. The bridge is in the care of the Commissioners for the Boston and Cambridge Bridges, and the city pays one-half the cost of maintenance. The bridge is in poor condition and should be extensively repaired this year.

*Cambridge Street Bridge (over Boston & Maine and Boston & Albany Railroads, Charlestown).*

This is a through steel truss bridge of four spans, built in 1901 by the Boston & Maine R. R. The surface is maintained by the city, the remainder by the railroad company. The sidewalks have been repaired. The bridge is very rusty and should be painted.

*Castle Island Footbridge (from Marine Park to Castle Island).*

This is a temporary footbridge, built in 1892, and is maintained by the Park Department. It connects Marine Park with Castle Island, and is furnished with a draw, so that if desired by the United States authorities the island can be cut off from the mainland. Repairs have been made on the planking. The fences should be painted and more planking should be renewed. The bridge is in fair condition.

*Central Avenue Bridge (over Neponset River, Dorchester Lower Mills).*

This is an iron bridge and was built in 1876. The city maintains the part within its limits. The sidewalk planking has been repaired, and is in good condition. The

roadway planking and some of the stringers are now being renewed. The fences should be painted. The ironwork is in good condition.

*Charles River Dam Bridge.*

This is a steel bridge in line with the roadway over Charles River Dam and is in charge of the Charles River Basin Commission. It was built in 1906-07 by the American Bridge Company and consists of a short fixed span 9 feet 2 inches in length on the westerly side and a movable portion 63 feet 10 inches in length. The movable portion is composed of two leaves of the Scherzer rolling lift type, 18 inches apart, each leaf having a roadway 30 feet 10 inches wide and a sidewalk 10 feet wide, and being operated by a 35 horse power electric motor. The bridge was opened to travel January 27, 1910.

*Charlesgate Bridge (over Boston & Albany R. R., in the Fens).*

This is an iron bridge, built in 1881-82, and is maintained by the Park Department. The railings have been repaired and painted, but the whole bridge should be cleaned and painted this year, and an opportunity given to make a careful examination of the ironwork. As the abutments are constantly settling, decreasing the head room over the railroad, the bridge should be raised to its former elevation at the time the stripping is done.

*Charlesgate Bridge (over Ipswich street, in the Fens).*

This is a deck plate girder bridge with a buckle plate floor built in 1900-01. The roadway is paved with asphalt and the sidewalks with artificial stone. The bridge should be painted as the portions under the sidewalks are in very rusty condition.

*Charlestown Bridge (from Boston to Charlestown).*

This bridge was opened to public travel November 27, 1899, and superseded the old Charles River Bridge, which was built in 1785-86.

The present bridge over the river consists of ten spans of the deck plate type, each 85 feet long, and a swing or turntable draw 240 feet 6 inches long.

The bridges over Water street and over the railroad tracks each consist of two spans of steel I-beams, with brick arches turned between the beams.



The drawtenders' house has been painted during the year. The steel work for the whole length of the bridge should be thoroughly cleaned and painted. The railings already have been allowed to rust so badly that in some panels the bottom rail has been eaten entirely through. The surfaces of both sidewalks are badly worn, that on the downstream side has now reached a condition which calls for resurfacing at once.

*Chelsea Bridge (over Boston & Maine R. R.).*

This is an iron bridge, built by the Boston & Maine Railroad Company in 1894, and is over the railroad location. The surface of the bridge is maintained by the city, the remainder by the railroad company. Repairs have been made on the sidewalk planking. The wheel guard is too low and narrow; the fences and sidewalk planking need repairing and the bridge needs painting; some of the track stringers begin to show decay. Otherwise the bridge is in good condition.

*Chelsea Bridge North (over North Channel, Mystic River).*

The city maintains the part within its limits. The original structure was built in 1802-03. The piles under the main bridge were driven in 1880. The upper part of the bridge, the draw and draw foundations were built in 1895. The draw-way was widened to 60 feet in 1900, the draw foundation being enlarged, the draw lengthened and the draw piers built. The draw has been strengthened, its flooring has been renewed, and the floor beams have been painted. The waterway has been extensively repaired. The upper part of the bridge should be painted; new machinery should be provided; several truck wheels need renewing; an additional bearing should be provided at the skew end; the sidewalk planking should be repaired; the track stringers and the fences should be repaired; the old fender guards are in poor condition.

*Chelsea Bridge South (over South Channel, Mystic River).*

This is a pile bridge with an iron draw. The original bridge was built in 1802-03. The piles of the present bridge were driven and the draw was built in 1877. That part of the bridge above the girder caps was rebuilt at a higher grade and the draw was raised in 1895. The landings of the draw have been repaired. Where the rebuilding of 1895 joins the old work repairs are needed

on both sides of the bridge. The draw is too light for the present travel; the bridge should be rebuilt.

*Chelsea Street Bridge (from East Boston to Chelsea).*

This is a wooden pile bridge with a steel swing draw. The original bridge was built in 1834. It was rebuilt in 1848, 1873, 1894-95 and in 1908-09. The bridge is 347 feet long, about 100 feet of the Chelsea end was built in 1894-95 and strengthened in 1906; the rest of the bridge, including the draw, was built in 1908-09 and was opened to all travel January 3, 1910. (See page 48.)

*Circuit Drive Bridge (over Scarboro Pond, in Franklin Park).*

This is an elliptical masonry arch of 30 feet span and 6 feet 3 inches rise. It was built in 1893 and is maintained by the Park Department.

*Columbia Road Bridge (over Old Colony Division, New York, New Haven & Hartford R. R., and Old Colony Avenue).*

This is a deck plate girder bridge of two equal spans, one over the tracks of the N. Y., N. H. & H. R. R., and the other over Old Colony avenue, and was built in 1902. The roadway is paved with Canton brick, cement grout joints, and laid on hard pine planking. The sidewalks are badly cracked and should be put in good condition without further delay. Some painting has been done, but the whole bridge should be painted, the portion over the avenue being very rusty.

*Columbia Road Bridge (over Shoreham street).*

This bridge was built in 1902. It is a two-span steel beam structure, with brick and concrete arches turned between the beams; the roadway is paved with Canton brick laid with cement grout joints. The sidewalks are of artificial stone. The girders and all the exposed steel work are rusting badly and should be painted at once to prevent the further corrosion of the structure.

*Columbus Avenue Bridges (over Boston & Albany R. R. and Providence Division, New York, New Haven & Hartford R. R.).*

The bridge over the Boston & Albany R. R. was built in 1876-77 and is maintained by the city. In

1899 the bridge was shortened 11 feet at its south end and a pier built in place of the old south abutment. In 1907 new plate girders were built on the center side of each roadway and the roadway floor strengthened. The bridge is now in good condition, except the sidewalk floor beams which should be strengthened.

The bridge over the tracks of the N. Y., N. H. & H. R. R. was built in 1899 and is maintained by that company. The asphalt pavement needs patching.

*Commercial Point or Tenean Bridge (Dorchester).*

This is a wooden pile bridge with a wooden leaf draw. The piles were driven in 1875. The draw and upper part of the bridge were rebuilt in 1901. The fences should be repaired and painted and the blocking supporting the machinery should be renewed. Otherwise the bridge is in good condition.

*Commonwealth Avenue Bridge (in the Fens).*

This is an iron bridge and was built in 1881-82. It has had an entire new hard pine lower planking put on during the past year and the sidewalks have been patched. The railings should be painted, otherwise the bridge is in good condition. It is maintained by the Park Department.

*Congress Street Bridge (over Fort Point Channel).*

This is a wooden pile bridge, with an iron turntable draw on a stone foundation, and was built in 1874-75. The part of the bridge above the caps was entirely rebuilt in 1908 and the machinery of the draw span put in good order. This year the draw fender pier was replanked, new stringers put in, new floor built in the drawtenders' house and the house painted. The bridge is now in good condition and can probably be maintained so for the next ten years.

*Cottage Farm Bridge (over Boston & Albany R. R., Brighton).*

The present bridge was built in 1895-96. With the exception of the plate girders on the outside lines of the bridge and some special construction under the sidewalks, the superstructure is composed of 20-inch steel

beams, filled between with brick arches and Portland cement concrete, on which is a wearing surface of Sicilian rock asphalt. The bridge should be painted and the asphalt roadways repaired; otherwise it is in good condition.

*Cottage Street Footbridge (over Flats, East Boston).*

This is a wooden pile bridge, built in 1889, for foot travel. It was extensively repaired in 1905. The sheathing and some of the stringers need renewal and the fences should be painted.

*Craigie Temporary Bridge.*

This is a wooden pile bridge, built by the Charles River Basin Commission to accommodate travel during the construction of the Charles River Dam. It was opened to travel July 2, 1905, and was closed to travel January 27, 1910, when the traffic was turned over the roadway at the dam. This bridge will soon be removed.

*Curtis Street Bridge (over Boston & Albany R. R., East Boston).*

This is a through steel plate girder bridge, built by the railroad company in 1906 under the decree of the Superior Court abolishing the grade crossings in East Boston. It was opened to travel December 29, 1906. The surface of the bridge is maintained by the city and the rest of the structure by the railroad company. The bridge should be painted; otherwise it is in good condition.

*Dartmouth Street Bridges (over Boston & Albany R. R. and Providence Division New York, New Haven & Hartford R. R.).*

The bridge over the Boston & Albany R. R. was built in 1878-79 and is maintained by the city. Very extensive changes were made in this bridge in 1899 by the railroad companies, necessitated by the new location of the tracks of the N. Y., N. H. & H. R. R. leading to the South Station and the abandoning of the tracks connecting this road with the Boston & Albany R. R. Some of the hangers and the bottom flanges of the floor

beams over the main tracks have been reduced in section so materially by the corrosive action of the fumes from the locomotives that it will be necessary to rebuild portions of this bridge next year.

The bridge is now in fair condition and can be kept so the next two years. The question of building a new structure should, however, be considered this year.

*Dorchester Avenue Bridge (over Fort Point Channel).*

This is a wooden pile bridge, with a double retractile iron draw, and was rebuilt in 1891-92. The lower part of the draw has been painted. The fences and upper part of the draw should be painted. The sidewalk planking and a few curb stringers on the draw should be renewed; the track timbers should be repaired; the sills and planking on the wharves, waterway and piers need renewal; some of the spur shores have begun to decay and should be refitted; the waterway should be repaired and the wreckage among the piling should be removed. ✓

*Dorchester Avenue Bridge (over Old Colony Division New York, New Haven & Hartford R. R.).*

This is a steel bridge, built in 1900, over the new location of the N. Y., N. H. & H. R. R. The surface of the bridge is maintained by the city and the rest of the structure by the railroad company. The bridge should be painted. The deck planking will need renewal within a couple of years. The bridge is in fair condition. ✓

*Dover Street Bridge (over Fort Point Channel).*

This was originally a wooden pile bridge, built in 1805, rebuilt in 1858-59, and again in 1876. In 1893-94, upon the abolition of the grade crossing of the Old Colony R. R., the present iron structure, resting on masonry piers, was built. The sidewalks on the draw have been replanked. The planking on the wharves has been repaired and miscellaneous repairs have been made. The bridge should be painted this year; new track is needed for the draw; the rack should be adjusted in order that the draw may be reversed; the concrete of the draw foundation pier should be repaired and the other piers should be repointed; the end lifts need repairing and the draw should be raised. The waterway needs repairing. The upstream asphalt sidewalk needs resurfacing. ✓

*Ellicott Arch Bridge (in Franklin Park).*

This is a semicircular masonry arch of 17 feet 6 inches span. It was built in 1889 and is maintained by the Park Department.

*Everett Street Bridge (over Boston & Albany R. R., Brighton).*

This is an iron bridge, built in 1891 by the Boston & Albany Railroad Company. The bridge was cleaned and painted and a new floor built for roadway and sidewalks in 1908. The bridge is now in good condition.

*Fens Bridge (in the Fens).*

This bridge was built in 1891-93. It is in good condition.

*Ferdinand Street Bridge (over Boston & Albany R. R.).*

This is an iron bridge, built in 1892. In 1899 this bridge was shortened about 3 feet at its southerly end and the old south abutment replaced by a brick pier. The bridge is now in fair condition except the fences; these should be repaired and painted.

*Florence Street Bridge (over Stony Brook).*

This is a wooden stringer bridge of about 15 feet span, and is in fair condition.

*Forest Hills Entrance Bridge (in Franklin Park).*

This bridge was built in 1894-95. It is maintained by the Park Department and is in good condition.

*Gainsborough Street Footbridge (over Providence Division, New York, New Haven & Hartford R. R.).*

This is an iron footbridge, erected in 1904. New wooden treads have been put in on the stairways the past year. The bridge is in good condition except the paint; it is recommended that the bridge be painted this year.

*Gold Street Bridge (over Midland Division, New York, New Haven & Hartford R. R.).*

This is an iron bridge with a wooden flooring and was built in 1895, replacing a footbridge which was built in 1890. The sidewalk planking has been repaired.



The bridge is very rusty and should be painted this year and the fences should be repaired. The walls need a small amount of pointing, otherwise the bridge is in good condition.

*Granite Bridge (from Dorchester to Milton).*

This is a wooden pile bridge with a wooden leaf draw. The city maintains the part within its limits. The bridge was originally built in 1837. The draw and the adjoining bay were repaired in 1907, and during the past year the rest of the bridge was entirely rebuilt. Four bents of oak piles were driven, new hard pine caps, stringers and lower planking were put in and spruce sheathing and sidewalk plank laid. The work was done under a contract with William H. Ellis at a cost of \$2,743. The abutment was also repaired where the sewer outlet passes through it.

*Harvard Bridge (from Boston to Cambridge).*

This is an iron bridge with an iron turntable draw, and was built in 1887-91. This bridge is in the care of the Commissioners for the Boston and Cambridge Bridges, and the city pays one-half the cost of maintenance. The roadway of the fixed spans was repaired in 1901-02 and a wooden block paving laid. In 1905 the asphalt walks were replaced by 3-inch hard pine and the railings were painted. During the year the draw span has been thoroughly repaired and raised about 2 inches by the insertion of metal shims between the girders and the drum. This raising was necessitated by the gradual shrinkage and compression of the timber work on which the draw rests. New hard pine roadway stringers and new roadway flooring have been laid, the end floor beams have been strengthened and the apparatus for lifting the ends of the draw has been thoroughly repaired. The draw span is now in good condition. The draw fender pier and the fender guards should be repaired and the whole bridge painted. It is recommended that this work be done this year.

*Harvard Street Bridge (over Midland Division, New York, New Haven & Hartford R. R., Dorchester).*

This is a steel bridge, built in 1904, under an agreement between the city and the N. Y., N. H. & H. R. R. The steel work is very rusty and should be cleaned and

painted this year, and the deck planking should be renewed within a couple of years. Otherwise the bridge is in good condition.

*Huntington Avenue Bridge (over Boston & Albany R. R.).*

The old bridge built in 1872 has been removed and a new bridge built during the year. (See page 50.)

*Huntington Avenue Bridge (over Muddy River).*

This is a semicircular masonry arch of 15 feet span. It was built in 1893 and is maintained by the park departments of Boston and Brookline.

*Hyde Park Avenue Bridge (over Stony Brook).*

This is a stringer bridge of 19 feet 9 inches clear span measured at right angles, and was built in 1904. It is in good condition.

*Ipswich Street Bridge (over Waterway, in the Fens).*

The bridge was built in 1898, and is in good condition, except the railings, which should be painted this year.

*Irvington Street Footbridge (over Providence Division, New York, New Haven & Hartford R. R.).*

This is a steel footbridge and was built in 1892. It is in fair condition, but will need painting in another year.

*L Street Bridge (over Reserved Channel, South Boston).*

This is a wooden pile bridge with an iron retractile draw. It was built in 1892. A new spruce deck has been put on the draw, a few stringers have been renewed, part of the draw has been painted, and some work has been done on the pier and track stringers. The bridge should be painted, except the part done last year, the waterway and planking on the pier and the sidewalks should be repaired. The piling in the fender guards and under the 6-foot walk are in poor condition. The planking under the abutment and wing walls on the South Boston side is being eaten by the worms and additional gravel should be deposited about the planking.

*Leverett Pond Footbridge (in Leverett Park).*

This is a segmental masonry arch of 24 feet span and 5 feet 5 inches rise. It was built in 1894, and is maintained by the Park Department.



*Longwood Avenue Bridge (over Muddy River and Boston & Albany R. R.).*

The original wooden structure was built in 1857 and rebuilt in 1877. The present masonry arches were erected in 1899 by the park departments of Boston and Brookline, and are maintained jointly by them.

*Malden Bridge (from Charlestown to Everett).*

This is a wooden pile bridge, with a retractile steel draw, and was rebuilt in 1900-01. The planking on the draw has been repaired and is now in fair condition. The bridge should be painted, the walks should be resurfaced, the paving should be repaired and some of the capsills on the pier should be renewed; about 50 feet of fence should be built on the wing of the abutment. Otherwise the bridge is in good condition.

*Massachusetts Avenue Bridge (over Boston & Albany R. R.).*

The original bridge was built in 1876 and the present structure in 1908. It is a deck plate girder bridge with steel floor beams, 6-inch hard pine roadway and 4-inch sidewalk planking. The roadway is paved with wooden blocks and the sidewalk with paving brick. It is in good condition.

*Massachusetts Avenue Bridge (over Providence Division New York, New Haven & Hartford R. R.).*

This is an iron bridge built in 1876. The roadways carrying street cars were strengthened in 1908, and new sidewalks were built last year. The middle roadway should be repaired and the whole bridge painted this year.

*Mattapan Bridge (from Dorchester to Milton).*

This is a three-arch bridge of Melan construction with granite facing. It was built in 1902 by the Metropolitan Park Commission and is maintained by it. The arches are semicircular, two spans being 14 feet and one 50 feet; the bridge has one 56-foot roadway and two 12-foot sidewalks. It is in good condition.

*Maverick Street Bridge (over the Boston & Albany R. R., East Boston).*

This is a through steel plate girder bridge, built by the railroad company in 1906 under the decree of the Superior

Court abolishing the grade crossings in East Boston. The surface of the bridge is maintained by the city and the rest of the structure by the railroad company. The fence should be painted. The bridge is in good condition.

*Meridian Street Bridge (from East Boston to Chelsea).*

This is a wooden pile bridge with a wooden turntable draw on a pile foundation. The original structure was built in 1858. It was rebuilt soon afterwards, and was widened and rebuilt in 1884, excepting the draw, which was built in 1875-76. The chords of the draw were rebuilt in 1896. The main part of the bridge was strengthened for the use of heavy electrics in 1906, and the draw was repaired and strengthened in 1907. Considerable work has been done on the waterways. The draw should be adjusted. The roadway planking, the waterways and the pier are in very poor condition. The bridge should be rebuilt within two years.

*Milton Bridge (from Dorchester to Milton).*

The city maintains the part within its limits. The original structure is very old. It was widened in 1871-72. The older part of this bridge was built of stone, and the widening is an iron structure on stone columns. The westerly sidewalk was rebuilt on new iron girders and floor beams in 1900. The sidewalks have been rebuilt and the iron beams and girders painted. The old planking on the bridge should be uncovered and examined, and it will probably need renewal. One of the capstones over the first waterway is cracked.

*Mt. Washington Avenue Bridge (over Fort Point Channel).*

This bridge was removed during the past year and the channelway dredged.

*Neponset Bridge (from Dorchester to Quincy).*

The city maintains the part within its limits. The original structure was built in 1802. The steel draw and the adjoining upper part of the bridge has been rebuilt. The Boston end of the bridge, built in 1877, is in poor condition and should be rebuilt; the piers are in very poor condition.

*Neptune Road Bridge (over Boston, Revere Beach & Lynn R. R.).*

This is an iron bridge, built in 1887-88, and is maintained by the Park Department. The sidewalk planking has been renewed; the bridge should be painted. Otherwise it is in good condition.

*Newton Street Bridge (over Providence Division, New York, New Haven & Hartford R. R.).*

This is an iron bridge, built in 1872. A new lower planking has been laid this year and such stringers as were found in poor condition have been replaced by new timber; new fences have been built and the ironwork cleaned and painted. This bridge is one of the oldest in the city, but can probably be maintained in safe condition for two or three years longer if carefully watched and the deck is kept in good condition.

*Norfolk Street Bridge (over Midland Division, New York, New Haven & Hartford R. R., near Blue Hill Avenue Station).*

This is a through lattice girder bridge, and was built by the railroad company in 1902. The surface of the bridge is maintained by the city and the rest of the structure by the railroad company. The steel work has been painted and the bridge is in good condition except sidewalk planking, which should be renewed or thoroughly repaired.

*Norfolk Street Bridge (over Midland Division, New York, New Haven & Hartford R. R., near Dorchester Station).*

This is a steel bridge, built in 1905, under an agreement between the city and the N. Y., N. H. & H. R. R. The bridge is very rusty and should be painted and the boxing at the trusses should be repaired. Otherwise the bridge is in good condition.

*North Beacon Street Bridge (from Brighton to Watertown).*

The city maintains the part within its limits. This is a wooden pile bridge with a wooden leaf draw. The original structure was built in 1822, and the present one in 1884. The bridge is in poor condition. It should be rebuilt without a draw.

*North Harvard Street Bridge (from Brighton to Cambridge).*

This bridge was originally built in 1662, and was rebuilt, except the piling, in 1879; the draw was built in 1891. The bridge is in the care of the Commissioners for the Boston and Cambridge Bridges; the city pays one-half the cost of maintenance. The bridge is in very poor condition, and the building of a new bridge should be commenced at once.

*Northern Avenue Bridge (over Fort Point Channel).*

(See page 53.)

*Oakland Street Bridge (over Midland Division, New York, New Haven & Hartford R. R.).*

This is a new steel plate girder bridge, built by the railroad company in 1902 under the decree of the Superior Court abolishing the grade crossing at this point. The surface of the bridge is maintained by the city and the rest of the structure by the railroad company. The steel work has been painted and slight repairs made to the sidewalks during the year; the planking of both walks should be renewed this year.

*Perkins Street Footbridge (over Boston & Maine R. R. and Boston & Albany R. R., in Charlestown).*

This bridge was built in 1900 and opened to travel February 2, 1901. It has two spans of wooden stringers and one span of steel Pratt trusses. The surface is maintained by the city, the rest of the structure by the railroad companies. The fence has been repaired and painted. The bridge should be painted. The smoke from locomotives is eating part of the steel of this bridge rapidly, and it will soon need repairing.

*Porter Street Bridge (over Boston & Albany R. R., East Boston).*

This is a through steel truss bridge, built in 1906-07 by the railroad company under the decree of the Superior Court abolishing grade crossings in East Boston. The surface of the bridge is maintained by the city and the rest of the structure by the railroad company. It is in good condition.

*Prescott Street Bridge (over Boston & Albany R. R., East Boston).*

This is a new through steel plate girder bridge, built by the railroad company in 1906-07 under the decree of the

Superior Court abolishing grade crossings in East Boston. The surface of the bridge is maintained by the city and the rest of the structure by the railroad company. The bridge should be painted. Otherwise it is in good condition.

*Prison Point Bridge (from Charlestown to Cambridge).*

This bridge includes a steel draw and its landings and was built in 1907. The original bridge was built in 1833. The bridge is in the care of the Commissioners for the Boston and Cambridge Bridges, and the city pays one-half the cost of maintenance. The shafting has been adjusted and the machinery has been housed in. A drawtenders' house should be provided and part of the old pier should be rebuilt.

*Public Garden Footbridge.*

This is an iron bridge and was built in 1867. Some new wooden floor beams were put in during the year, but the entire woodwork should be renewed this year, as recommended in last year's report, if it is proposed to keep the present structure in service.

*Saratoga Street Bridge (over Boston & Albany R. R., East Boston).*

This is a through steel plate girder bridge, built in 1907 by the railroad company under the decree of the Superior Court abolishing grade crossings in East Boston. The surface of the bridge is maintained by the city and the rest of the structure by the railroad company. The bridge should be painted; otherwise it is in good condition.

*Scarboro' Pond Footbridge (in Franklin Park).*

This is an elliptical masonry arch of 40 feet span and 8 feet 3 inches rise. It was built in 1893 and is maintained by the Park Department.

*Shawmut Avenue Bridge (over Boston & Albany R. R. and Providence Division, New York, New Haven & Hartford R. R.).*

The original bridge, built in 1871, was removed and a new through plate girder bridge erected in 1904. The bridge is in good condition, but should be painted in a thorough manner this year.

*Southampton Street Bridge (over South Bay Sluice).*

This is a wooden bridge, built in 1875 as a temporary structure. It is in very poor condition and should be rebuilt.

*Southampton Street Bridge (over Old Colony Division, New York, New Haven & Hartford R. R.).*

This is a steel plate girder bridge, built in 1901-02. The surface is maintained by the city, the rest of the structure by the railroad company. The bridge has been redecked and the boxing at the girders renewed. The bridge should be painted.

*Spring Street Bridge (from West Roxbury to Dedham).*

This is a stone bridge. The city maintains the part within its limits. The piers and arches were pointed in 1905 and granite copings, surmounted by iron railings, built on both sides of the bridge. The part within the city's limits is now in good condition, but the railings should be painted the coming summer.

*Summer Street Bridges (over A, B and C Streets).*

These bridges were built in connection with the abolition of the grade crossing on Congress street and were opened to travel in 1900. The bridge over A street is a steel deck plate girder structure, with a paved roadway of granite blocks and asphalt sidewalks.

The bridge over B street is a through plate girder structure, with a paved roadway of granite blocks and asphalt sidewalks.

The bridge over C street is a two-span steel beam structure, with brick and concrete arches turned between the beams; the roadway is paved with granite blocks and the sidewalks with asphalt.

These bridges are in good condition, except that those over B and C streets should have some painting done on them.

*Summer Street Bridge (over Fort Point Channel).*

This bridge was built in 1899-1900 in connection with the abolition of the grade crossing on Congress street. It is a four-span deck plate girder bridge, resting on masonry piers, with two retractile draws over a 50-foot channelway. The roadway of the fixed spans has a



granite block paving, and the sidewalks have asphalt wearing surfaces. The whole structure should be painted this year and the draws and the draw foundations should be replanked.

*Summer Street Bridge (over New York, New Haven & Hartford R. R. Freight Tracks).*

This bridge was built in 1900 in connection with the abolition of the grade crossing on Congress street, and is maintained by the city and the railroad company, the former maintaining the wearing surface and the latter maintaining the rest of the structure. It has four spans, consisting of three through trusses each, and has a granite paved roadway and asphalt sidewalks. The whole bridge is now in good condition with the exception of the sidewalks. The walks laid on this bridge were made of an asphalt composition containing but a small percentage of asphalt; they are now in very poor condition and should be rebuilt or resurfaced this year.

*Sumner Street Bridge (over Boston & Albany R. R., East Boston).*

This is a through steel plate girder bridge, built by the railroad company in 1908 under the decree of the Superior Court abolishing the grade crossings in East Boston. The bridge was opened to travel of all kinds June 22, 1908. The surface of the bridge is maintained by the city and the rest of the structure by the railroad company. It is in good condition.

*Warren Bridge (from Boston to Charlestown).*

This is a wooden pile bridge, with a double retractile iron draw. The present structure was built in 1883-84. The downstream pier and wharf have been replanked and some stringers have been added; some of the deck planking and the downstream corner of the waterway have been repaired; the lower part of the draw has been painted and miscellaneous repairs have been made. The fender guards on the Charlestown side are in poor condition; the sides of the waterway, the planking on the upstream wharf and in the draw pit should be extensively repaired; the curbing on the draw should be realigned; the landing shoes need adjustment; the sidewalk and fencing on the westerly side of the bridge, city end, should be extended about 20 feet, and

the concrete sidewalks should be resurfaced. The mid-way sections near the gates should be rebuilt; additional oak sleepers are needed on the track timbers, and a few sidewalk piles should be strengthened.

*Webster Street Footbridge (over Boston & Albany R. R., East Boston).*

This is a new through steel truss bridge, built by the railroad company in 1908 under the decree of the Superior Court abolishing the grade crossings in East Boston. The surface of the bridge is maintained by the city and the rest of the structure by the railroad company. It is in good condition.

*West Fourth Street Bridge (over Old Colony Division, New York, New Haven & Hartford R. R.).*

In 1893-94 the grade crossing of the Old Colony R. R. on this street was abolished, and an iron bridge built, extending from the end of Dover Street Bridge, at the South Boston side of Fort Point channel, to the easterly line of Foundry street. The surface is maintained by the city, the rest of the structure by the railroad company. The sidewalk planking has been put in fair condition. Some of the stringers near Dover Street Bridge and some of the boxing are in poor condition and need repairing and the bridge should be painted.

*West Rutland Square Footbridge (over Providence Division, New York, New Haven & Hartford R. R.).*

This is an iron footbridge, built in 1882. New treads have been built on all stairways during the past year and the bridge is now in fair condition.

*Western Avenue Bridge (from Brighton to Cambridge).*

This bridge is in the care of the Commissioners for the Boston and Cambridge Bridges, and the city pays one-half the cost of maintenance. The draw and upper part of this bridge is now being rebuilt. The bridge was closed to team travel December 14, 1909, provision being made for foot travel across the channel by a temporary bridge. (See page 70.)

*Western Avenue Bridge (Brighton to Watertown).*

The city maintains the part within its limits. This is a wooden pile bridge with an iron draw, and was



rebuilt in 1892-93. Only minor repairs have been made; the Boston end of the draw should be raised; the draw should be adjusted and the bearings under the ends of the girders should be renewed; the planking and capsills on the piers and along the waterways should be repaired; some of the spur shores are broken and should be refitted; the sidewalk planking and deck planking on draw and main bridge need renewal, also some of the planking on the draw foundation, and the bridge should be painted this year; some of the piles in the fender guard are in poor condition.

*Winthrop Bridge (from Breed's Island to Winthrop).*

This is a pile bridge without a draw. It was originally built in 1839; it was rebuilt in 1851; extensively repaired in 1870 and has been repaired many times since. The abutment at the Winthrop end needs pinning up, as there has been some settlement; the bulkhead at the Boston end, some of the outside bolsters and the roadway planking are in very poor condition. Some of the piles are somewhat eaten by worms; the piles in deep water should be examined by a diver, and additional piles may be needed. The waterway should be partially filled, and the bridge should be rebuilt of a shorter length. If this bridge is to be kept in service extensive repairs should be made at once.

*Wood Island Park Footbridge.*

This is a steel footbridge, built in 1898-99, and connects Prescott street, East Boston, with Wood Island Park, spanning the tracks of the Boston, Revere Beach & Lynn R. R. The bridge is in good condition.

*Bridges wholly Supported by Railroad Corporations.*

Harrison Avenue Bridge, over the Boston & Albany R. R. is in poor condition and should be rebuilt. The other highway bridges maintained by the several railroad companies are in good or fair condition.

SURVEYING DIVISION.

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The work of the Surveying Division during the past year has consisted of the making of such surveys and plans as have been required by the several city departments, and giving lines and grades of public streets when requested by abutters intending to build.

\* Forty-two petitions requesting that catch-basins should be constructed were reported upon to the Sewer Division.

\* One hundred and two plans of streets showing proposed locations of future catch-basins were furnished on request of the Sewer Division.

\* Two hundred and fifty-five catch-basins were staked out on request of the Sewer Division, and duplicate sketches showing locations of spikes, ties, etc., were furnished.

\* Measurements have been obtained on twenty-five streets for the Sewer Division, for the purpose of making sewer assessments.

\* Two hundred and forty-four plans of proposed underground pipes, conduits, etc., were examined for the Sewer Division, and locations for proposed future catch-basins were marked on plans.

Three hundred and forty-two notices of contracts to lay artificial stone sidewalks were received, lines and grades were marked, the work measured when completed and reported upon to the Street Department. In one hundred and thirty cases the Street Department was notified that existing edgestones should be reset preparatory to the laying of artificial stone.

Seventy notices of the completion of repairs to artificial stone sidewalks were received, the work measured and reported upon to the Street Department.

Twenty-nine petitions to make sidewalk openings for areas, bulkheads, etc., were received from the Street Department and reported upon.

One hundred and sixty-nine requests for edgestone were examined and the amount required reported upon to the Street Department.

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\* This work was performed jointly by the Engineering and Street Laying-Out Departments.

Sidewalk grades for forty-one streets were furnished engineers and architects for plans of twenty-one new buildings.

Eleven plans of streets were made for sidewalk assessments on request of the Street Department.

Eighteen hundred and eighty-six orders were attended to for the Highway Division; these consisted of staking out new streets for construction, giving lines and grades for repairs and reconstruction of old streets, testing lines and grades after completion of work, and measuring the amount of work performed and making plans showing quantities to be assessed upon abutting owners.

Estimates for grade, land and building damages and cost of construction were furnished the Street Commissioners on thirty-one streets.

The lines and grades of twelve streets, for which the Street Commissioners were petitioned for authority to open as private ways, were examined and reported upon.

\* Six miscellaneous reports were made to the Sewer Division.

Nineteen miscellaneous reports were made to the Highway Division.

The following table gives the comparative annual amounts of paving work measured by the Surveying Division of the Engineering Department for sixteen years:

YEAR ENDING JANUARY 31.	Feet of Edge- stone Set.	Square Yards Block Stone Paving and Crossings.	Square Yards Round Stone Paving.	Square Yards Brick Paving.	Square Yards Artificial Stone.	Square Yards Coal Tar Concrete.	Square Yards Asphalt Paving.
1895.....	23,487	12,007	5,175	6,168	3,962	11,738	1,406
1896.....	129,383	60,472	32,940	68,701	12,296	183	1,297
1897.....	120,158	64,952	24,976	68,178	13,471	2,971	394
1898.....	154,718	100,414	36,658	94,003	13,599	4,019	27
1899.....	76,991	56,541	14,249	43,930	11,652	1,619	.....
1900.....	86,354	60,803	17,323	48,946	14,221	789	16
1901.....	264,982	161,428	61,356	147,863	16,541	489	2,377
1902.....	245,410	188,041	30,324	131,487	15,565	698	.....
1903.....	104,133	135,310	5,077	59,051	14,119	25	.....
1904.....	60,555	65,474	4,815	29,078	12,806	248	62
1905.....	30,899	54,455	184	16,268	9,906	196	.....
1906.....	67,114	65,132	1,264	27,544	12,981	3,551	.....
1907.....	140,878	101,118	17,390	82,044	20,135	3,716	.....
1908.....	52,380	76,216	3,386	30,339	16,635	1,926	.....
1909.....	1,743	6,706	742	1,423	14,846	83	.....
1910.....	5,161	2,061	944	2,277	21,547	23	.....

\* This work was performed jointly by the Engineering and Street Laying-Out Departments.

Table showing the amount of paving work measured by the Surveying Division for the year ending January 31, 1910, by districts:

DISTRICTS.	Square Yards Arti- ficial Stone Side- walk.		Linear Feet of Edge- stone.		Square Yards Block Stone Paving.		Square Yards Round Stone Paving.		Square Yards Brick Paving.		Linear Feet Artificial Stone Curb.		Square Yards Macadam.		Square Yards Gravel Sidewalks.		Square Yards Coal Tar Concrete.	
	Old.	New.	Old.	New.	Old.	New.	Old.	Old.	New.	New.	New.	New.	New.	Old.				
Boston Proper.....	72	1,345	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	
South Boston.....	134	487	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	
Roxbury.....	728	2,910	2,441	580	887	204	21	1,671	584	16	.....	.....	.....	.....	.....	.....	.....	
Dorchester.....	523	12,245	85	.....	29	.....	.....	.....	.....	142	.....	.....	.....	.....	.....	.....	.....	
West Roxbury.....	.....	1,720	137	1,831	97	629	.....	22	.....	8	1,900	1,104	23	.....	.....	.....	.....	
Brighton.....	.....	1,383	87	.....	215	.....	923	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	
Totals.....	1,457	20,090	2,750	2,411	1,228	833	944	1,693	584	166	1,900	1,104	23	.....	.....	.....	.....	

Table showing the amount of paving work measured by the Surveying Division for the year ending January 31, 1910, by months:

MONTHS.	Square Yards Artificial Stone Sidewalk.		Linear Feet of Edge-stone.		Square Yards Block Stone Paving.		Square Yards Round Stone Paving.		Square Yards Brick Paving.		Linear Feet Artificial Stone Curb.		Square Yards Macadam.		Square Yards Gravel Sidewalks.		Square Yards Coal Tar Concrete.	
1909.	Old.	New.	Old.	New.	Old.	New.	Old.	Old.	New.	New.	New.	New.	New.	Old.				
March.....	.....	671	137	1,831	97	629	.....	22	.....	.....	1,900	1,104	.....					
June.....	.....	1,041	87	.....	215	.....	923	.....	.....	10	.....	.....	.....					
July.....	233	1,300	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....					
August.....	520	6,125	85	.....	29	.....	.....	.....	.....	132	.....	.....	.....					
September.....	56	697	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....					
October.....	226	2,238	.....	.....	.....	.....	.....	.....	.....	8	.....	.....	.....					
November.....	7	3,420	882	580	311	204	21	567	584	.....	.....	.....	.....					
December.....	415	4,500	1,559	.....	576	.....	.....	1,104	.....	16	.....	.....	23					
1910.																		
January.....	.....	98	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....					
Totals.....	1,457	20,090	2,750	2,411	1,228	833	944	1,693	584	166	1,900	1,104	23					

Surveys and plans have been made for the taking of land for school purposes on Fayette street and Knox street, city proper, for an addition to the Abraham Lincoln School lot; on Massachusetts avenue, city proper, of estate purchased for a girls' industrial school; on Webster street and Brigham street, East Boston; on Reed street, Hunneman street and Harrison avenue, Roxbury; on Ruggles street and Winthrop place, Roxbury; and on Hutchings street and Brookledge street, Roxbury.

Plans were made for the Public Buildings Department of Central square, East Boston, for the proposed erection of a courthouse; and of the primary schoolhouse site on Poplar street, West Roxbury, sold at public auction.

A plan was made for the Water Department, showing the taking of land for the purpose of laying a water main from Long Island to Spectacle Island.

A plan was made for the Fire Department of land and wharf on Lewis street, East Boston.

Plans were made for the revision of grades of four streets, in connection with the abolition of grade crossings on the line of the Old Colony Railroad, between Harrison square and Neponset.

Plans were made of Dover street and West Fourth street, showing revised grades occasioned by the abolition of the grade crossing with the Old Colony Railroad.

Surveys and plans have been made for the Park Department of land to be taken for park purposes; on Boardman street and Saratoga street, East Boston, for a playground; on West Third street, Bolton street and B street, South Boston, for a playground; on West Fifth street and Gold street, South Boston, for a playground; on Norfolk avenue and Proctor street, Roxbury, for a playground; and of Savin Hill Park, in Dorchester.

A plan of the Dorchester lockup on Miller's lane was made for the purpose of showing the property conveyed by the City of Boston to Walter Baker Company.

Ninety-eight plans of interiors of schoolhouses, to be used for polling places, were made for the Election Department.

A plan was made of a portion of Newton, proposed to be annexed to the City of Boston, embracing the property of Boston College and others.

Among the more important plans made for the Street

Laying-Out Department may be mentioned those showing the extension of Dix place to Tremont street; the widening of Hyde Park avenue from Ashland street to the Hyde Park line; and studies for the development of the Park square property.

Petitions for the registration of land in the Land Court are referred to the Mayor whenever the City of Boston is an interested party.

These cases are examined by the Law Department and the Surveying Division of the Engineering Department for the purpose of protecting the city's interests.

During the year seventy-five such cases have been investigated.

There were 109 accident and other plans made for the Law Department.

In connection with the Surveying Division there have been 1,242 titles examined, 415 deeds and 353 plans copied from the Registry of Deeds.

Thirty-six hundred and thirty-eight blueprints have been made during the year.

List of plans of takings for Sewerage Works filed during the year ending February 1, 1910:

#### EAST BOSTON.

*Ashley avenue*, from Ashley avenue to Leyden street.

*Ashley avenue*, from Ashley avenue to Leyden street, additional.

*Lubec street*, from Prescott street southwesterly.

#### ROXBURY.

*Lamont street*, from Lamont street to Prentiss place.

*Marbury terrace*, in railroad land at end of.

*Vila street*, from Longwood avenue to Riverway.

#### WEST ROXBURY.

*Belgrade avenue*. Three plans from Belgrade avenue to Birch street, Wood and Shepard land.

*Grew avenue*, from Canterbury street to Hyde Park line.

*Stony brook*, from Morton street northeasterly.

*Stony brook*, additional at Morton street.

*Washington street*, from Washington street to Stony brook.

*Wilfret street*, from Wilfret street to Linnet street.

*Zellar street*, from Hewlett street to Selwyn street.

## DORCHESTER.

*Burt street*, from elevated car barn to Burt street, rear of Ashmont street.

*Longfellow street*, along line of No. 22 Longfellow street.

*Oakland Garden branch*, from Greenwood street to railroad.

*Wildwood street*, additional taking from Hildreth street to Wildwood street.

## BRIGHTON.

*Harvard avenue*, in rear of Princeton avenue.

The following sectional plans made under the Board of Survey Act have been refiled during the year:

T- 77	} Dorchester	. . . . .	12
T- 81			
T-100			
U- 90			
U- 91			
W- 68			
W- 69			
W- 70			
X- 22			
X- 36			
X- 45	} West Roxbury	. . . . .	2
Y- 52			
Z- 44			
Z- 57			
N- 29	} Brighton	. . . . .	3
N- 30			
N- 31			
			<u>17</u>

Forty-three assessment plans were made for the Street Commissioners.

Sixty-one plans and profiles, representing a total length of seven and one-sixth miles, showing buildings, property owners' names, established grades, area of land taken, or to be taken, for street widenings, relocations, or laying out, were completed for the Street Laying-Out Department.



The following list gives the number of orders attended to for property owners, builders and the various city departments from February 1, 1909, to February 1, 1910:

Street lines given . . . . .	470
Street grades given . . . . .	318
Street Department, Highway Division . . . . .	1,886
* Street Department, Sewer Division . . . . .	839
Law Department . . . . .	210
Street Laying-Out Department . . . . .	184
Engineering Department . . . . .	80
Schoolhouse Commission . . . . .	22
Transit Commission . . . . .	11
Park Department . . . . .	7
Police Department . . . . .	7
Charles River Dam Commission . . . . .	6
Building Department . . . . .	5
Public Buildings Department . . . . .	4
Cemetery Department . . . . .	2
Wire Department . . . . .	2
Water Department . . . . .	2
Assessing Department . . . . .	2
Fire Department . . . . .	1
Hospital Department . . . . .	1
Election Department . . . . .	1
Mayor . . . . .	1
	<u>4,061</u>

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\* This work was performed jointly by the Engineering and Street Laying-Out Departments.



There are on file with the Surveying Division 34,948 indexed plans.

There are also 3,563 lithographed plans in the office at Old Court House not included in the foregoing list, viz.:

Lithographed maps of Dorchester, made in 1869 . . . . .	33
" " " " 1880 . . . . .	121
" " West Roxbury, made in 1873 . . . . .	8
" " Fort Hill, made in 1866-69 . . . . .	77
" " Church street district, made in 1868 . . . . .	168
" " Washington street widening (parts 1, 2, 3), made in 1860 . . . . .	1,186
" " Washington street extension, made in 1869 . . . . .	324
" " North street, made in 1859 . . . . .	44
" " Stony brook, drainage area . . . . .	10
" " Boston, made in 1866-67 . . . . .	98
" " Boston, made in 1888 . . . . .	30
" " Suffolk street district, made in 1869 . . . . .	3
" " South Boston, made in 1880 . . . . .	60
" " Roxbury, made in 1880 . . . . .	81
" " burnt district . . . . .	62
" " Mt. Hope Cemetery . . . . .	19
" " Winthrop Farm . . . . .	49
" " Hanover avenue . . . . .	44
" " Muddy river . . . . .	41
" " Pemberton square, courthouse site . . . . .	195
" " East Newton street, lots on, sold by auction, made in 1888 . . . . .	42
" " public lands in South Boston, sold by auc- tion, made in 1885 . . . . .	82
" " public lands in South Boston, sold by auc- tion, made in 1888 . . . . .	8
" " Boylston street, old Public Library lot . . . . .	17
" " public lands in South Boston, sold by auc- tion, made in 1882 . . . . .	136
" " Boston Directory map, made in 1886 . . . . .	60
" " Boston, scale 1,600 feet to an inch, made in 1890 . . . . .	74
" " Boston, scale 800 feet to an inch, made in 1891, colored plans . . . . .	5
" " Boston proper, scale 500 feet to an inch, made in 1894 . . . . .	10
" " Exhibit No. 1, City Surveyor's Report, 1893, . . . . .	34
" " Exhibit No. 2, City Surveyor's Report, 1893, . . . . .	63
" " Exhibit No. 3, City Surveyor's Report, 1893, . . . . .	96
" " High street, public lands sold by auction . . . . .	16
" " Beacon Hill, State House site . . . . .	38
" " Harrison avenue, Savage Schoolhouse lot, auction plan . . . . .	57
" " Boston proper, showing changes in street and wharf lines from 1795 to 1895 . . . . .	172
	<hr/>
	3,563

## MISCELLANEOUS WORK AND CONSTRUCTION.

ABOLISHMENT OF GRADE CROSSINGS ON THE BOSTON,  
REVERE BEACH & LYNN RAILROAD.

This matter has been under consideration throughout the year. Several plans and estimates have been made, especially those relating to the doing away with the grade crossing on Saratoga street. Careful surveys, plans and estimates have been made for the abolishment of this crossing. The subject is now being considered by the Board of Railroad Commissioners, to whom it was referred by the Superior Court. Several hearings have been held but no report has as yet been made.

## ASHMONT STREET AND DORCHESTER AVENUE BRIDGE.

In the autumn plans and specifications were prepared for extending this bridge northerly on the line of the railroad, and on November 11 a contract was made with Jones & Meehan for doing the work. Nothing has been done upon the ground, but construction will begin as soon as the weather is favorable.

## BOSTON COMMON SURVEY.

During the year, at such times as could be spared from other work, a topographical survey of the Common has been in progress and it is nearly completed.

## BOSTON COMMON WATER PIPES.

Plans have been made for a system of piping to supply water for irrigation. These provide for about 4,500 lineal feet of 6-inch main pipe and 3,200 lineal feet of 4-inch branch pipe for supplying hydrants. There are to be 34 hydrants, so placed that all parts of the grounds where there are trees can be reached by lines of hose not exceeding 125 feet in length.

On December 6 a contract was made with the Florence Iron Works of Philadelphia, Penn., for furnishing the pipe required. The pipe has all been delivered on the Common at a cost of \$3,225.68.

On November 29 a contract was made with the Lumsden & Van Stone Company of Boston for furnishing special castings for gates, hydrants, bends, etc. These have all been delivered at a cost of \$479.

The small supplies and the shop work on the gates and hydrants have been furnished by the Boston Water Department.

On December 1 a contract was made with the Rowe Contracting Company of Boston for laying the pipe. Work was begun on December 2 but has not been completed.

#### BOSTON CONSUMPTIVES' HOSPITAL.

The work of building the service road under the contract with B. F. Carroll of Brookline, dated June 22, 1908, was completed on August 13, and he was paid \$7,404.18.

The work included the completion of the grading of the road and adjoining slopes, excavation for water pipe, building drains for surface water and the surfacing of the road. The road is 1,373 feet in length and 15 feet in width except in the rear of the hospital ward building where it is 25 feet wide. The road extends from River street along the easterly boundary of the hospital property to the service entrance to the first ward building. A paved gutter 3 feet wide is laid on the easterly side of the road; the remainder of the road surface is a telford macadam 12 inches thick. Drains were built for carrying the surface water from the road. On account of the large area of adjoining land draining on to the road, pipes varying in size from 12 to 24 inches in diameter were required; five catch-basins of the standard size of the Street Department were built; the drain discharges into a previously existing culvert under River street; this culvert has an inadequate outlet on the southerly side of the street and a larger pipe should be laid from this point to the Neponset river. Where the road is in excavation 6-inch agricultural tile drains surrounded by broken stone were laid on the easterly side of the road to take care of the ground water.

On August 10 a contract was made with J. H. Ferguson for doing work around the power house, including the building of a road from the service road to the coal pocket of the building, the grading of a road to the boiler room entrance and the building of a concrete area wall

and steps at the entrance to the laundry; this contract also included the grading of the grounds between the service road and the new ward building. Work under this contract was completed on December 2 at a cost of \$1,440.43.

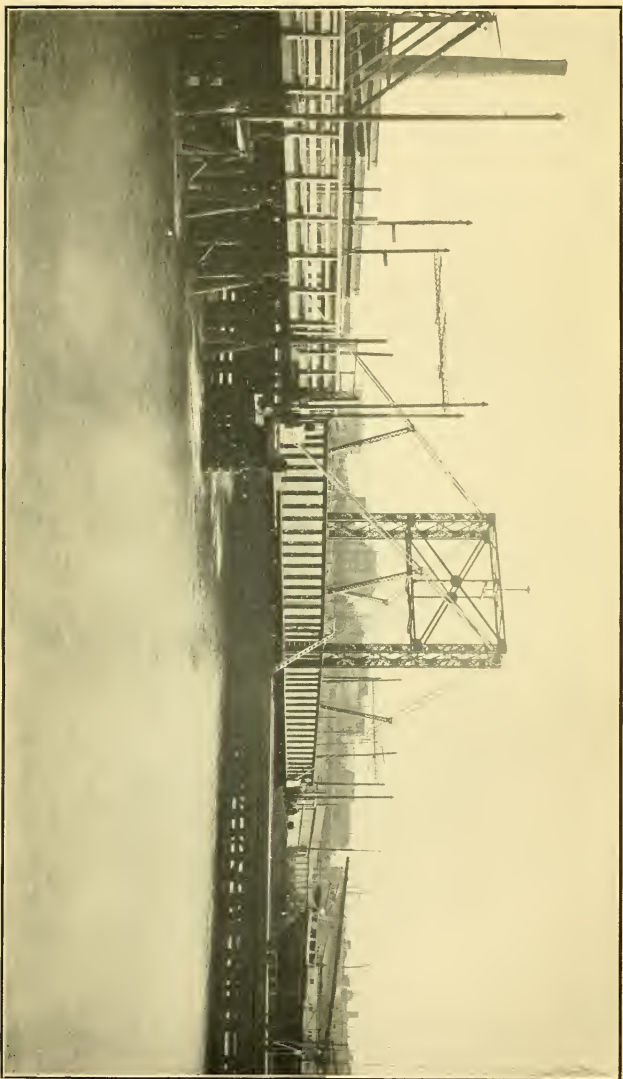
#### CHELSEA STREET BRIDGE, EAST BOSTON TO CHELSEA.

The contract with W. H. Ellis for building the draw foundation and both ends of the bridge, mentioned in the last annual report, was so far advanced in May that the completion of the work was delayed until the new draw, built under another contract, could be swung into position. The entire work was completed January 10, 1910.

A contract was made May 7, 1909, with the New England Structural Company for building a new steel draw, which was completed December 9, 1909. The new draw span is of the center bearing swing type, a riveted steel structure on a pile foundation. It is 30 feet wide between the centers of the main plate girders and 175 feet in length. The outer ends of the four main girders are supported by a center tower with eyebar suspension rods. The floor beams and stringers are steel and the bridge surfacing, both of the roadway and sidewalk, is wood. The draw has a roadway 22 feet 2 inches wide between curbs, and one sidewalk 6 feet in width. It carries two street car tracks, and is designed for the heaviest passenger trolley cars used by the Boston Elevated Railway Company. The draw span is turned by electricity, the current being furnished, free of cost, by the street railway company. The ends of the draw span are raised and supported by steel wedges operated by hand gearing. The motor, controller and rheostat for operating the draw were furnished by the General Electric Company and installed by the Barnes-Pope Electric Company. The operating machinery was furnished and installed by the Walworth Construction and Supply Company, except the gearing, which was furnished by the Holyoke Machine Company. The draw was swung into position and opened to foot travel November 22, 1909, and was fully opened to team travel January 3, 1910.

A drawtenders' house has been built on the pier by W. H. Ellis. The hot-water plant for the house was furnished by A. B. Franklin.

The total cost of the work to January 31, 1910, was



CHELSEA STREET BRIDGE.



HUNTINGTON AVENUE BRIDGE. TRESTLE BENEATH OLD GIRDER.



\$47,422.96, some of the work being still under construction at the close of the fiscal year.

#### DEER ISLAND SHORE PROTECTION.

Several studies were made to ascertain some method of preventing further encroachment of the sea upon that part of the northerly shore of the island between Shirley Gut and the North Head sea wall. From a comparison of former surveys with those made recently it was found that there has been a constant encroachment by the sea upon this part of the island; since 1860 about seven acres have been washed away, the present high water line on a portion of this shore being now about 400 feet back of its location in 1860. This wasting has been partially offset by the deposition of material by the sea on the Shirley Gut side of the island to and above high water over a considerable area.

Plans were made for a riprap breakwater and bids were received on August 2 for its construction, but no award was made as the bids were considered to be too high. The matter was further considered and a plan was made for a concrete sea wall on the shore line. Alternative bids were advertised for, for a breakwater on either of two lines or for the concrete wall. A contract was made on September 22 with J. H. Ferguson for building the concrete wall. Work was begun on September 29, and about 300 lineal feet of wall was practically completed before the close of the season.

#### FIRE STATION ON WALK HILL AND WENHAM STREETS.

Surveys, plans and specifications were made for grading the grounds and building a retaining wall on the northerly side of the land upon which a building for the Fire Department was to be erected, and on June 30 a contract was made with the Coughlan & Sheils Company for doing the work. The work was finished on September 7 at a cost of \$3,325.

The front part of the lot where the building was to be placed was graded to a level grade of 73 feet above city base with slopes of 2 to 1 from this grade up to the original surface of the rear part of the lot. A retaining wall of concrete was built just inside of the northerly property line to support the adjoining estate. The wall is 111 feet in length, of a height varying from just above the surface of the ground at the ends to a height of 14.5 feet above the new grade of the ground in front.

The wall is of Portland cement concrete composed of one part of cement to two parts of sand and four parts of broken stone or gravel. Ballast of stone chips was placed in rear of the wall.

#### HUNTINGTON AVENUE BRIDGE OVER BOSTON & ALBANY RAILROAD.

A contract for rebuilding Huntington Avenue Bridge over the Boston & Albany Railroad was made with the Boston Bridge Works, Incorporated, the lowest bidder, on June 3, 1909. The work of reconstruction was begun at the bridge site August 16 and completed December 12, 1909.

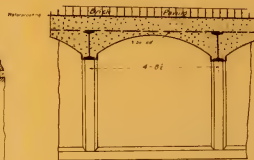
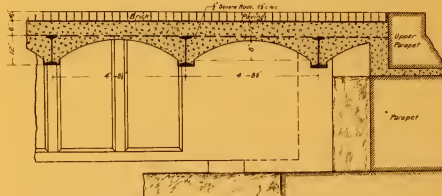
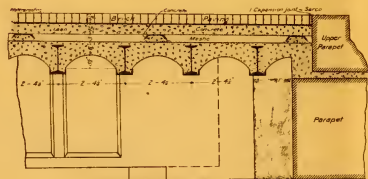
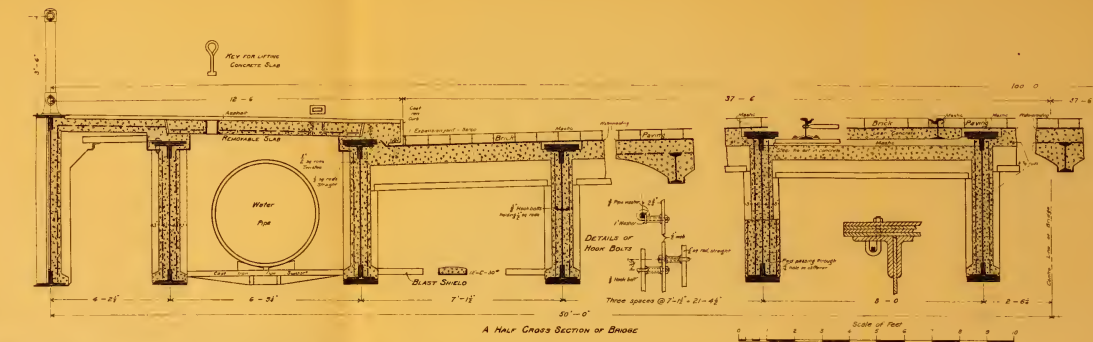
The original bridge was built in 1872, and in its thirty-seven years' service it had become badly corroded by the action of the locomotive gases. For several years prior to its removal, the iron girders carrying the street railway tracks had been supported at about mid-span upon a timber trestle placed between the tracks of the Boston & Albany Railroad. Upon removing the old bridge floor the very serious corrosion became apparent and the condition of the structure, as shown in the accompanying views, illustrates in a striking way the destructive effects of locomotive gases upon our metal bridges.

While the original Huntington Avenue Bridge was used for more than thirty years, its long life was due to the fact that it was made of wrought iron. Experience shows that steel corrodes much more rapidly under the action of locomotive gases, and a steel bridge as ordinarily constructed may be expected to last only fifteen to twenty years in a location such as this.

A notable feature of the reconstructed bridge is the use of concrete for the protection of all steel work beneath the bridge floor; the concrete protection of the steel work being reinforced by steel in a manner similar to that used at the Boylston Street Bridge in 1908. It is expected that the concrete protection will greatly prolong the life of this structure and reduce the cost of maintenance to almost nothing, so that notwithstanding the larger first cost this bridge should show considerable economy over a structure in which metal work is unprotected.

The new bridge is a deck plate girder structure, 89 feet 2 inches in length between faces of parapets by 100 feet in width, and consists of sixteen heavy steel



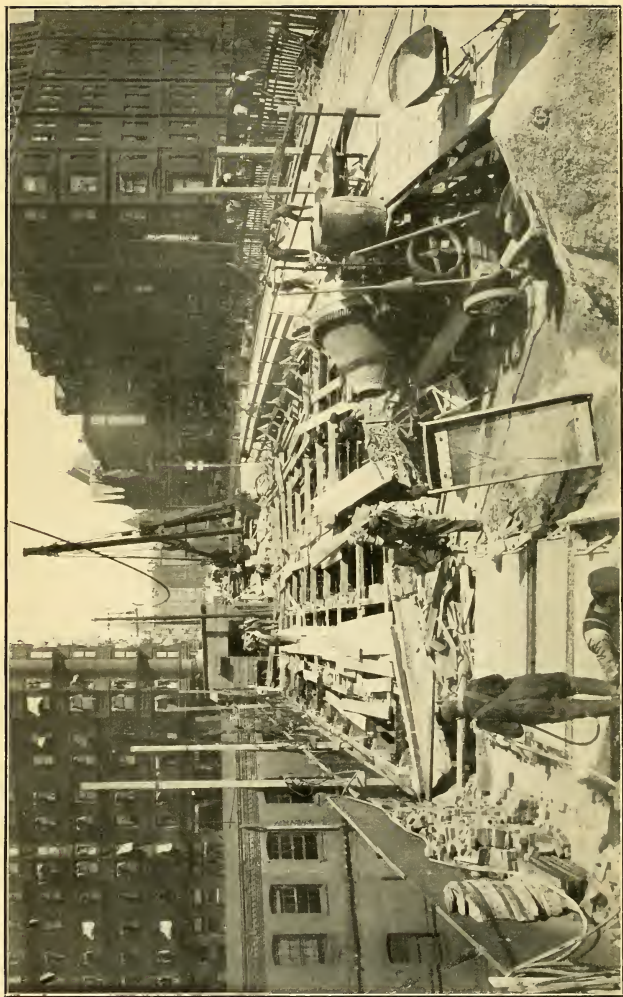


HUNTINGTON AVENUE BRIDGE. FLOOR CONSTRUCTION AND ENCASEMENT OF STEEL.





HUNTINGTON AVENUE BRIDGE. CORROSION OF OLD GIRDER.

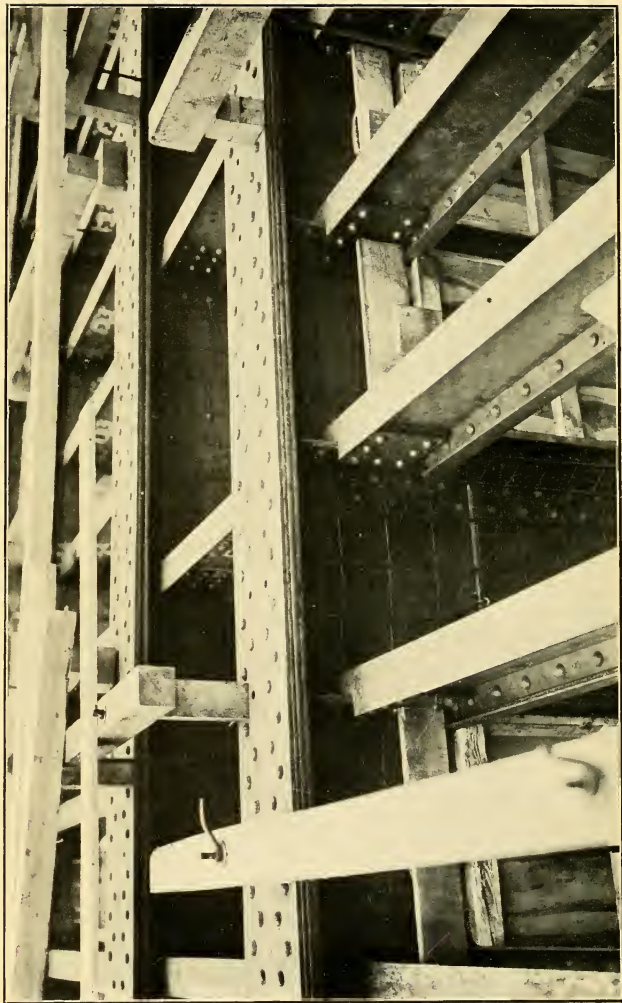


HUNTINGTON AVENUE BRIDGE. ERECTION OF NEW BRIDGE.



HUNTINGTON AVENUE BRIDGE. FORMS FOR CONCRETE.





HUNTINGTON AVENUE BRIDGE. REINFORCEMENT FOR CONCRETE.

girders between which are placed steel floor beams. The concrete protection of the girders is about 4 inches in thickness, and the floor beams are encased in, and protected by, concrete floor arches. The roadway of the bridge is surfaced with a brick block pavement, beneath which there is a layer of waterproofing. The sidewalks have an asphalt surface on a concrete floor. Provision for water pipes and for structures of public service corporations is made beneath the bridge. Over the water pipes, which are beneath the sidewalks, the concrete floor has been constructed in the form of removable slabs so that access to the pipes may be had when occasion requires.

In the middle of the roadway are laid two tracks for the surface cars of the Boston Elevated Railway Company. Additional strength was provided in this portion of the bridge so as to carry street cars of fifty tons weight instead of the standard highway wagon load of twenty tons. The parapets of the masonry abutments were rebuilt and the street approaches on each side were resurfaced to conform to the slightly altered grade. Typical features of the bridge are illustrated by the accompanying photographs and plates.

During the work of reconstruction, street car travel was maintained at all times, upon one or both tracks and team travel and foot travel were also provided for.

The reconstructed bridge represents the very latest type of construction for bridges over steam railroads and some of the features of the design are unique and, so far as is known, have not been previously used elsewhere.

The cost of construction was as follows:

The Boston Bridge Works, Incorporated:

Total payments under contract for bridge superstructure and reconstruction of abutments and southerly approach . . . . .	\$47,802 45
Simpson Brothers Corporation: Street resurfacing . . . . .	123 45
Warren Brothers Company: Resurfacing northerly approach . . . . .	558 40
Engineering and inspection . . . . .	3,810 70
Printing, advertising and incidentals . . . . .	152 50

Total cost of the work . . . . .	<u>\$52,447 50</u>
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The work was done under sections 23 and 25, part 1, chapter 463 of the Acts of 1906, as amended by chapter

542, Acts of 1908, and further amended by chapter 47, Acts of 1909, under which it is expected that the Boston & Albany Railroad and the Boston Elevated Railway Company will be called upon to share in the expense. The apportionment of the cost of the work by a special commission is yet to be made.

#### INDEPENDENCE SQUARE WALKS.

On September 29 a contract was made with the Warren Brothers Company for replacing about 2,000 square yards of the old coal tar concrete walks with artificial stone and for repairing the remainder of the tar concrete walks. Work was begun on October 7 and was completed on December 14 with the exception of a portion which was damaged by frost. Final payment has not yet been made.

#### NORTHERN AVENUE AND SLEEPER STREET.

The work of building Northern avenue and Sleeper street, as required by chapter 381 of the Acts of 1903, has continued during the year and on February 1, 1910, the part of the avenue and street required to be built by the City of Boston was completed and turned over to the care of the Superintendent of Streets. The portion, however, from Atlantic avenue across Fort Point channel and along Sleeper street was opened to public travel October 26, 1908, as stated in the last report of this department.

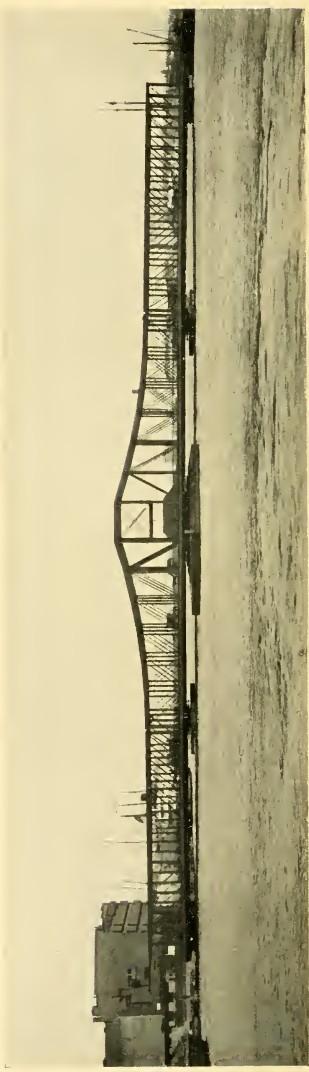
The act of the Legislature authorizing the work, laid out Northern avenue from Atlantic avenue easterly to Fort Point channel, thence across the channel and thence across lands leased by the New York, New Haven & Hartford Railroad and lands of the Commonwealth; it also laid out Sleeper street from Congress street over the private way known as Sleeper street and over lands of the above-named railroad company to Northern avenue. The act further required the City Engineer of Boston in the name and behalf of the city to construct the portion of the avenue from Atlantic avenue to the lands of the Commonwealth and the whole of Sleeper street as laid out.

As the work authorized by the act of the Legislature to be done by the city has now been completed, the following description is given of the entire work. For convenience this description will be divided into two





HUNTINGTON AVENUE BRIDGE. THE SIDEWALK OF REMOVABLE SLABS.



NORTHERN AVENUE BRIDGE. VIEW FROM CONGRESS STREET.

parts, one dealing only with the bridge across Fort Point channel and the other with the approaches from Atlantic avenue and from Congress street, and the avenue on the South Boston side of the channel.

#### NORTHERN AVENUE BRIDGE.

The bridge across the channel is 80 feet wide and consists of two through truss spans, each about 150 feet long, separated by a swing draw span about 283 feet long; also a short deck span of plate girders, of an average length of 55 feet, at the South Boston end. While the act required that the two channel ways should be "not less than 60 feet wide," as a result of the hearing before the Harbor and Land Commissioners these ways were made each 75 feet wide in the clear.

*Bridge Foundations.*—The building of the substructure of the bridge began in September, 1905, the plans for the same having been approved by the Harbor and Land Commissioners July 18, 1904, and by the Secretary of War April 11, 1905.

Borings made before the work of construction was begun showed that the bed of the channel was a layer of soft black silt, varying in thickness from 3 to 6 feet and overlaying a stratum of soft blue clay. The top of this clay was from 20 to 26 feet below city base, and extended to a depth of more than 60 feet below city base, gradually becoming harder from the admixture of sand and gravel until at 90 feet below city base there was very little clay remaining in the material.

The fixed spans of the bridge are supported on masonry piers and abutments, the Boston abutment and one pier on the westerly side of the channel, and the South Boston abutment and two piers on the easterly side; the draw span rests on a masonry draw foundation pier at the middle of the channel. The two channel piers located on the shore sides of the channel ways are of the same form and dimensions and similar in design to those built at the Summer Street Bridge. They consist of a mass of concrete supported by spruce piles forming the foundation which extends from city base to an elevation of 25 feet below that base. Above the foundation the pier is of granite masonry laid solid in cement mortar, and differs in outline from the usual rectangle form in the fact that the center line of the pier follows approximately the arc of the end of the swing draw span which rests upon it when the draw is in position for

travel. A material saving was effected in the amount of masonry used by the adoption of this design, not only in the pier itself but also in the foundation; the load on the piles and underlaying material was also very much reduced. The width of the foundation of the pier at elevation minus 25 is 18 feet 2 inches for the greater portion of its length, the last 15 feet at each end tapering to a width of about 14 feet 6 inches at the extreme end.

The piles were driven in alternate rows of five and six piles each, spaced 15 inches on centers; the piles in the rows were spaced from 27 to 30 inches on centers, and staggered with the piles in adjoining rows. All piles except those on the center line of the pier were driven at an inclination of 1 in 12, spreading outward from the centers, thus increasing the area of the foundation over which the piles distribute the load coming on them. Seven hundred and fifty-four piles were used under each channel pier.

The order of construction of this pier was substantially as follows: The mud and other material were excavated to a depth of at least 3 feet below the required bottom for the concrete; this was done to insure ample depth for the concrete after the clay had been forced up by the driving of the piles, clean gravel filling being deposited where necessary to bring the bottom to the elevation required for the concrete. The spruce piles used were not less than 6 inches in diameter at the point and were driven to a depth not less than 50 feet below city base. The average length of piles driven in the channel piers was  $32\frac{1}{2}$  feet and, as they were driven by an apparatus which enables the full length of the piles to be utilized, the load on the piers was distributed on the underlaying clay at a depth of about 54 feet below city base. As soon as the piles in the pier were driven a cofferdam made of 6-inch splined hard pine sheeting was constructed to serve as a mold for the concrete in the foundation. Owing to the irregular form of the foundation, part of the sheeting was driven plumb and part at an inclination of 1 in 12, the sheeting being held in position during driving by double wale pieces attached to piles driven outside the sheeting for that purpose. To facilitate the laying of the masonry the top of the cofferdam was built at about half tide, but on completion of the work the sheeting was cut off at the top of the lower wale pieces approximately at mean low water.

After the cofferdam was in place the space inclosed was filled with Portland cement concrete composed of one part Portland cement, two parts of sand and four parts of sound broken stone or pebbles, all parts by measure. The concrete was mixed by a machine mixer and deposited through an iron chute or tube in the same manner as was followed at Summer Street, Charlestown and Cambridge Bridges, and is fully described in previous reports of this department.

The piers above the concrete foundation are built of granite laid solid in Portland cement mortar; the exposed surfaces are quarry-faced, pitched to line, with no projection of more than 3 inches. The ends and vertical joints were dressed to lay  $\frac{1}{2}$ -inch joints. The faces of the pier under the coping show six courses of 25-inch rise. The bottom course is composed entirely of headers approximately 4 feet square, the other courses being laid with alternate headers and stretchers, the headers showing a width of 2 feet on the face and extending half way through the pier and the stretchers varying in length between 5 and 6 feet, but of a uniform width of 30 inches. The backing is Portland cement concrete of the same proportions as used in the foundations; the coping stones of the piers are 24 inches deep, quarry-faced on vertical face and pean-hammered on top, dressed for  $\frac{3}{8}$ -inch joints and laid solid in mortar, the stones on the ends being doveled to the course below. All face joints are pointed with mortar composed of equal parts Portland cement and fine sand.

In cross section the channel piers are 8 feet 6 inches wide under the coping, increasing in width by a straight batter on each side to 9 feet 6 inches at the foundation, except for a length of 9 feet at each end where these widths are gradually reduced to about 7 feet at the extreme end. The coping in all cases projects 6 inches beyond the face of the body of the pier. The face of each end of the pier was built at right angles to the center line, and with a curved batter of 4 feet in 12 feet 6 inches.

The lengths of the channel piers measured at right angles to center line of the bridge are as follows: At coping 78 feet, under coping 77 feet and at top of foundation 85 feet.

The pier near the abutment at the South Boston side is the same length as the channel pier, but is rectangular in form and of the following cross section: 7 feet wide



under the coping and 8 feet at top of foundation; the coping is also 8 feet wide. The quality of materials and workmanship are the same as the channel piers, all headers, however, extend entirely through the pier and those of the bottom course are only 30 inches wide. The foundation of this pier extends to 20 feet below city base, and is 15 feet 10 inches wide at this elevation and 12 feet 6 inches wide at the top at city base; the length is 90 feet at both elevations. The piles were driven in alternate rows of four and five piles each and spaced substantially the same as in a channel pier and driven to the same depths. A total of 320 piles were driven in this pier.

The westerly abutment on the Boston side of the channel is a composite masonry structure, consisting of a front pier whose face is located on the harbor line and five lines of longitudinal piers extending back to the face of the old dock wall; on these piers steel I-beams rest which support concrete arches. The foundation of the front pier is of Portland cement concrete supported by piles, the concrete extending to a depth of 20 feet below city base, the width of the foundation being 11 feet at elevation 0 and 12 feet 8 inches at elevation minus 20. The piles under the pier were driven in alternate rows of three and four piles each, the front piles being driven at an inclination of 1 in 12. The soft silt was dredged out to a depth of about 3 feet below the proposed bottom of the concrete and clean gravel filling was deposited the same as for the piers. After the piles were driven a cofferdam made of 6-inch splined sheeting was constructed to serve as a mold for the concrete foundation, the concrete being the same as used for the piers and deposited in the same manner. After the masonry was completed the sheeting was cut off at city base.

The masonry of this abutment is similar in quality to that of the piers. In cross section the abutment is 7 feet thick at its base at elevation 0 and 6 feet 6 inches under the bridge seat at elevation 13. The bridge seat has a total width of 7 feet, of which 5 feet is pean-hammered on top to receive the shoe castings under the ends of the trusses. The parapet is 2 feet wide at the bridge seat and 12 inches at the top, which for the roadway is at the underside of the flooring of the bridge and for the sidewalk is at the surface of the walk. The face of the parapet and its top are rough pointed,

except the top at the sidewalk parapet which is pean-hammered. The upper course of parapet stones are doveled to course below.

The foundations for the longitudinal walls were carried down about 5 feet below the surface of the existing bottom and built in three steps, the portions adjoining the front pier being at elevation minus 12, the middle portions at minus 7.5 and the portion near the old wall at minus 3. In cross section the foundations of the center and outside walls were 6 feet 6 inches wide and the other two 5 feet wide, the piles under the former being in rows of three piles and under the latter in rows of two piles, all rows being spaced 3 feet 6 inches on centers. The total number used in the abutment was 348. The driving under the foundation was much harder than at any other location on the work, the average length of pile used being about 20 feet. The concrete used for these foundations was the same as for the other work and similar sheeting was used for molds.

The longitudinal walls were carried up to about 17 feet above city base to receive the reinforced concrete arches for supporting the surface of the street. The walls on the outside or street line were 4 feet thick, built of granite rubble masonry with concrete backing and capped by a granite coping 2 feet square, the top surface forming the outer edge of the sidewalk; the other walls were entirely of concrete, the one at the center of the street being 5 feet thick and the adjoining ones only 3 feet thick. As these inner faces are not exposed to the outer air and extreme changes in temperature it was not deemed necessary to protect them with granite as was done on the outer faces. The chambers between the walls were connected with the water of the channel by 12-inch cast-iron pipes, discharging 3 feet below city base; this insures a change of water with each rise and fall of tide. By means of a manhole and openings through the inner walls provision is made for an examination of these chambers at any time. The chambers between the longitudinal walls are spanned by 20-inch steel I-beams, weighing sixty-five pounds per foot, spaced 4 feet on centers and stayed by  $\frac{7}{8}$ -inch diameter rods, one every 30 inches;  $\frac{7}{8}$ -inch "Thacher bars" spaced 6 inches on centers being placed between the rods. The arches are trapezoidal in form, 14 inches deep at the center and 24 inches deep at the beams. The beams and rods were surrounded by a



Portland cement mortar composed of one part of cement and two parts sand, the mortar extending 2 inches below the bottom flange of the beams and held in place by expanded metal lathing, the rest of the arch being made of 1-2-4 Portland cement concrete.

The abutment on the easterly or South Boston side of the channel was built on the location of the old sea wall which was erected in 1878, the face of the abutment coinciding substantially with the face of the old wall. The old wall was built on a pile foundation, the plank platform being about 12 inches below city base. This wall, which was built of granite rubble laid dry, was removed for the width of the bridge and the ballast and filling back of it was also removed to the level of the platform. The preliminary design for this abutment provided for increasing the width of the base of the old wall about seven feet and driving a sufficient number of new piles, both vertical and inclined, to carry the increased load and resist the pressure back of the abutment. It was found, however, that the filling back of the old wall and below low water was made up entirely of granite quarry refuse, most of it so large as to render its removal impossible, except by divers. As this mass of stone had been in position for more than thirty years, and only a slight increase in loading was to be provided for, it was decided to omit the piles and consolidate the mass by a generous use of concrete and grout. The abutment as built has a granite face and cement concrete backing. In section the abutment is 16 feet 3 inches thick at the bottom, which is 20 inches below city base, 9 feet of this width resting on the pile platform of the old wall. At the bridge seat, at elevation 13.25, the abutment is 10 feet 7 inches thick, 8 feet of this being in front of the parapet, thus providing a very liberal bridge seat, which was considered advisable as it enabled the bearings of the girders to be set well back from the face. Provisions were also made to permit the abutment to move forward, not exceeding 12 inches, without necessitating any changes in the masonry or the steel work of the bridge.

The concrete foundation for the draw pier is circular in form, approximately 69 feet in diameter, and was carried down 25 feet below city base, the material being dredged 3 feet lower as for the other piers of the bridge. The spruce piles were of the same dimensions as other foundations and were driven in the same manner, 872

piles being driven within the area covered by the foundation. The wooden curb which served to retain the concrete was of the same construction as used at the Charlestown Bridge, and consisted of 3-inch by 10-inch spruce planks laid flatwise, spiked and treenailed together, and stiffened, as the laying of the planks progressed, by vertical hard pine timbers placed about 10 feet apart inside the curbing and bolted to it. The curbing was built floating in the water and sunk in position as it was built. The curbing was 30 feet high and was carried up to elevation 4 feet above city base and filled with Portland cement concrete of the same consistency and deposited in the same manner as for the other foundations.

As the bottom of the track castings and the center pivot pedestal was at practically half tide it was necessary to protect the turntable and operating mechanism by a circular wall carried above extreme high tide. This wall is 3 feet in thickness and has a granite face and concrete backing, the concrete being a rich mixture of one part Portland cement, one and one-half parts sand and three and one-half parts of sea-washed pebbles, varying in sizes from  $\frac{1}{4}$  inch to  $2\frac{1}{2}$  inches. The concrete was laid with especial care and a very smooth surface was obtained on the inside. The face joints in the masonry were  $\frac{1}{2}$  inch thick and were pointed in a very careful manner, the mortar being of equal parts of cement and sand, with an admixture of about 10 per cent. of very fine clay. The result obtained was very satisfactory, a practically water-tight wall having been secured. The wall was capped by a granite coping 18 inches thick and 3 feet 6 inches wide, laid in cement mortar with  $\frac{3}{8}$ -inch joints, the top and back of coping being pean-hammered and the front quarry-faced. Within the pit formed by the circular wall the foundation for the turntable track and center pedestal was built. A four-ply waterproofing was laid on the concrete foundation, extending over the whole area, terminating at an annular gutter built just inside the wall, which was designed to collect any water that might reach this pit. This waterproofing was laid between tides in the most thorough manner and covered at once with sufficient concrete to withstand the pressure of the incoming tide. The bearing stones for the turntable track set in cement mortar were 21 inches in thickness, forming a ring 6 feet wide, the center line of which was 40 feet in diameter. The surfaces of these stones were

pean-hammered and set very carefully at elevation 5.90 feet above city base. The rest of the floor of this pit was of concrete of rich proportions, having a smooth mortar finish 1 inch thick, which pitched from the center to the annular gutter, drains being provided through the bearing stones. Two lines of 6-inch cast-iron pipes with gates were built in the wall through which any water that might collect in the gutter could be discharged into the channel; but it is found that the floor of the bridge prevents rain water from gathering in the pit and the pipes have been cut out of service.

The draw fender pier is the largest the city has ever built, its width being 88 feet and its length on the face of the channel from the center line of the bridge measured downstream is 290 feet and upstream is 215 feet, to which should be added the two triangular ends of 44 feet each measured on the center line, making the total length of the pier 593 feet. It is built of oak piles in bents at right angles to the channel, the bents being 16 feet apart; the piles are capped with 7-inch by 14-inch hard pine girder caps, the stringers are 6-inch by 12-inch hard pine, spaced 3 feet on centers, and the floor is of 3-inch hard pine; the piles are braced with rough oak or hard pine braces. On the channel faces the piles are spaced 4 feet on centers, braced with oak spurshores and capped with 7-inch by 14-inch hard pine girder caps and 12-inch by 12-inch hard pine stringers. The face has four lines of 8-inch by 12-inch hard pine walings, which are covered with 4-inch hard pine plank placed vertically, four additional lines of walings being used on the faces at the ends of the pier. The corners are all heavily ironed with  $\frac{3}{4}$ -inch plates and 26 heavy ringbolts are provided on the pier. The upstream portion of the pier has an area, in the middle, 60 feet wide and 144 feet long which is not floored over. Heavy fender guards are built to protect the channel piers, and the faces on the waterways are built of the same design as the channel face of the draw fender pier, the angles at the ends being braced in the most substantial manner.

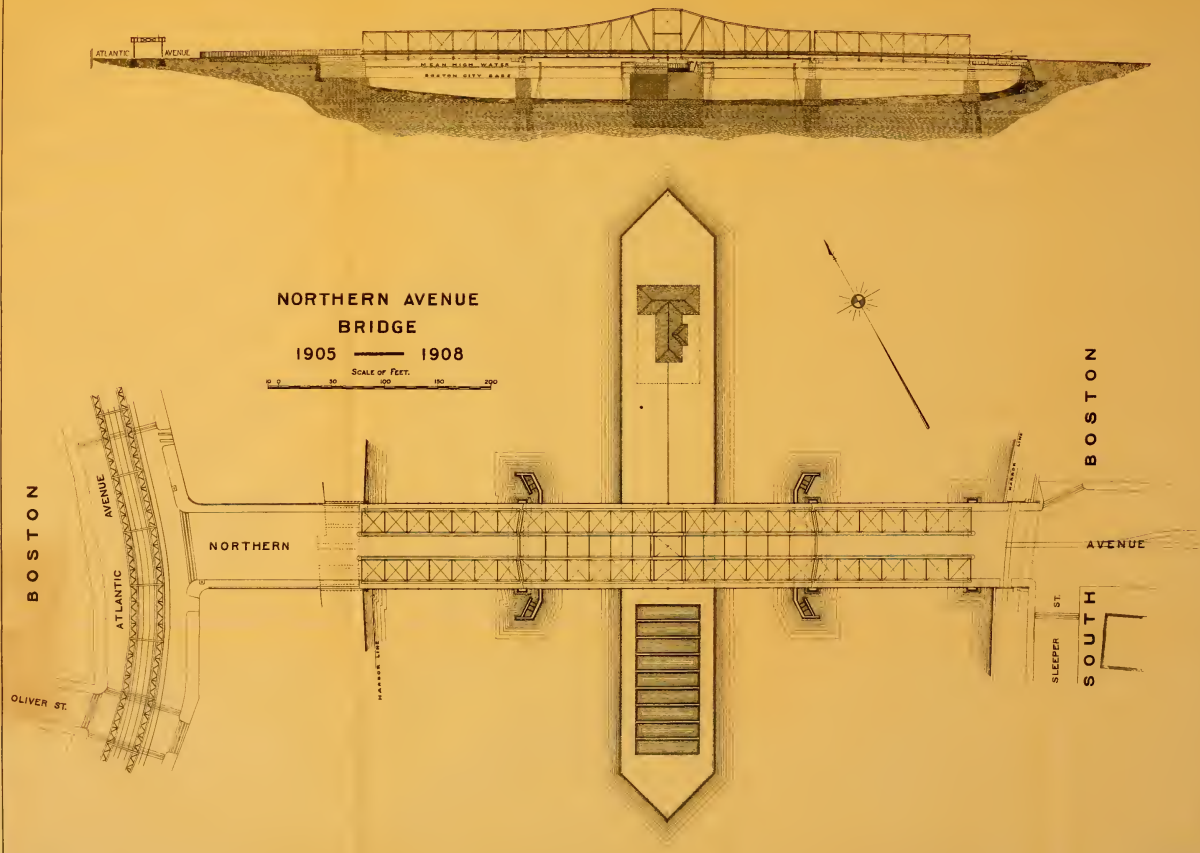
*Bridge Superstructure.*—The bridge was designed to carry a freight railway track on the center roadway beside the usual city traffic. Spans 1 and 2 are through truss spans substantially alike, each having four pin-connected trusses about 150 feet long, spaced 22 feet 8 inches on centers, supporting three roadways and two

NORTHERN AVENUE  
BRIDGE

1905 — 1908

SCALE OF FEET.

0 50 100 150 200





overhanging sidewalks; and span 3 is a deck plate girder span made up of six plate girders spaced 14 feet  $9\frac{1}{2}$  inches apart, with an average length of about 55 feet, carrying a freight railway track transversely across the span near the abutment end.

The draw span is a symmetrical swing draw of the rim-bearing type, 283 feet long and 79 feet  $1\frac{1}{2}$  inches between sidewalk fascias. It is made up of two independent spans about 125 feet 2 inches long, supported on a central tower. The outer trusses are carried by the inner ones by means of two cross trusses at the central tower. This tower carries the load to eight points on a circular drum, 40 feet in diameter, through a system of distributing girders. The whole draw weighs about 1,300 tons and rests on fifty-six steel wheels running between steel-faced tracks.

In all spans the floor beams are of built-up sections with steel stringers. The roadways of spans 1, 2 and 3 are paved with 6-inch granite blocks laid with pitch and pebble joints. These rest on 6-inch hard pine plank which is covered with waterproofing and sand. The sidewalks are of asphalt 4 inches thick laid on 4-inch plank. The roadway of the draw span is 5-inch hard pine plank, sheathed with 2-inch spruce plank, and the sidewalks are of 2-inch hard pine.

The power used for operating the draw is compressed air at a normal pressure of 200 pounds per square inch. This is generated by two double-stage air compressors, each geared to a 50 horse power motor using a 500-volt direct current. The compressors are arranged to start and stop by means of an automatic switch board whenever the pressure varies 15 pounds from normal. These compressors pump into eight steel receivers in the power house, having a combined capacity of 1,500 cubic feet. From the receivers a 4-inch main carries the air down the pier through the draw center to a position directly under the operator's stand on the deck of the draw. From here it is delivered at 200 pounds pressure to the end lifts and also, at 70 pounds pressure, to the engines which turn the draw.

The draw is revolved by two  $6\frac{1}{4}$ -inch by 10-inch double-cylinder engines attached with their trains of gears to the draw, the final pinion of each train acting on a rack attached to the track on the draw pier. These two sets of turning apparatus are independent and either can turn the draw if the other is out of order.



There are eight end lifts, one at the free end of each truss, operated by air at 200 pounds pressure. Each consists of a cylinder 16 inches in diameter operating a lever adapted in length to the load at this point and using as a fulcrum a cast-iron block on the stone pier. This mechanism raises the truss end about 5 inches to allow the bearing blocks to be slid beneath it. The four blocks at each end of the bridge are connected to a shaft, which the gateman operates by means of a lever from the deck of the fixed span. The truss ends are lowered about a half inch onto the bearing blocks and the end lifts are released before traffic passes onto the draw. In this position the span on one side of the central tower acts independently of the span on the other.

The operator's stand is between two of the roadways near the center of the draw. From here he can watch the street traffic as well as the navigation, and controls by levers and valves all the turning and lifting mechanism. Automatic signals show the movement of each lifting lever and sliding block and sights enable him to close the draw to exact position. Hand apparatus is provided in case of emergency, both for revolving the draw and raising the ends.

#### THE APPROACHES AND THE AVENUE.

The layout of the avenue on the Boston side of the channel provided a street 80 feet in width with curves of short radii at the junction with Atlantic avenue, and covered a taking of 15,171 square feet west of the harbor line. The old buildings and wharves on this area were removed and filling deposited to bring the street to the required grade, concrete walls being built on both side lines for their entire length to support the filling. Catch-basins were built on the Atlantic avenue end and connected with the sewer in that avenue; the street was paved with granite blocks with gravel joints, granite edgestones set and the sidewalks paved with brick. The paved roadway is 64 feet wide, and sidewalks are each 8 feet wide. Substantial board fences were built on both sides extending from the bridge to Atlantic avenue.

The approach to Northern avenue from Congress street, as laid out by act of the Legislature, included a private way 40 feet wide, known as Sleeper street,



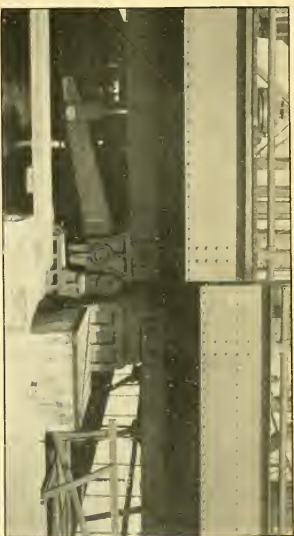


ERRATA FOR ILLUSTRATIONS.  
SHOWING NORTHERN AVENUE BRIDGE, END LIFTS.

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For "C. Bearing block slid beneath end" read "B. End raised by lever."

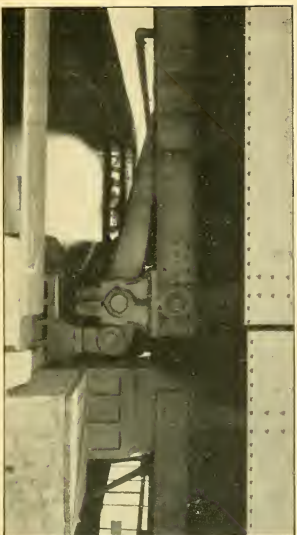
For "B. End raised by lever" read "C. Bearing block slid beneath end."



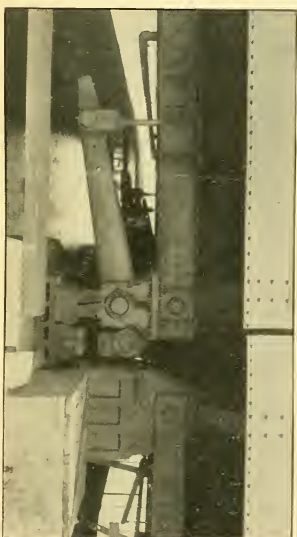
A. Draw closed, end hanging.



B. End raised by lever.



C. Bearing block slid beneath end.



D. Resting on bearing block; lever released.

# NORTHERN AVENUE BRIDGE. END LIFTS OF DRAW IN OPERATION.

Compare railing on fixed span (to right) and railing on draw span (to left) before and after raising.



NORTHERN AVENUE BRIDGE. DRAWTENDERS' HOUSE.

which extended from Congress street to the railroad lands, a length of about 635 feet, and which had been in use for nearly twenty years. The land for this portion of the street was released to the city by the railroad company and the Boston Wharf Company without compensation. The other portion of Sleeper street was laid out by the act, 50 feet in width, over the lands of the railroad company for a length of about 433 feet; the area of land taken was 21,964 square feet, for which a payment of \$42,055.67 was made to the railroad company. The construction work done on Sleeper street consisted of the repaving of the roadway of the portion 40 feet wide, and rebuilding the portion 50 feet wide. The latter portion was graded and paved with granite blocks, using gravel joints, granite edgestones were set and sidewalks were paved with brick; catch-basins were also built and connections laid for discharging the surface water directly into the channel. A single sidewalk, 7 feet wide, was built on the westerly side of this portion of the street.

The avenue on the South Boston side of the channel was laid out by the act to a uniform width of 100 feet across the lands of the railroad company and the Commonwealth, and the city was required to build the street as far as the division line between the lands of the Commonwealth and the New York, New Haven & Hartford Railroad Company, a total length on the northerly line of 2,031.45 feet and on the southerly line of 2,042.10 feet, measured easterly from the harbor line on the west side of Fort Point channel. The area of land released by the railroad company for this portion of the avenue was 203,781.50 square feet. While the original act provided for this release without compensation by the City of Boston, the New York & New England Railroad Company made a claim against the Commonwealth for compensation for a portion of the land, based on an agreement made in 1882. Under chapter 229 of the Acts of 1904 an adjustment of the claim of the railroad company was made by the Board of Harbor and Land Commissioners by which the Commonwealth paid \$22,595.60, or at the rate of 20 cents per square foot for 95,228 square feet of land and 50 cents per square foot for 7,000 square feet. The total amount paid the railroad company by the city and the Commonwealth for land for the avenue and the Sleeper street approach was \$64,651.27.

The most difficult feature of the work in connection with the building of this avenue was the construction of the sea walls at the ends of the docks of the railroad company, designated as docks Nos. 1, 2 and 3. At the first two of these docks it was necessary to provide 30 feet of water at low water, and borings taken at the locations of these walls showed that the material on which they must rest was blue clay, extending to a depth of more than 100 feet below city base, and not until nearly that depth was reached was there even a small percentage of sand found.

The design adopted for the wall at the head of dock No. 1, and which received the approval of the Harbor and Land Commissioners, June 21, 1907, provided for a granite masonry wall on a pile and concrete foundation, with a relieving platform also supported on piles. The wall, which is 174 feet long, measured on the coping, was built between the old side walls of the dock. These walls were of dry rubble masonry, extending to low water, and rested on spruce piles. As timber wharves were built in front of these walls, 20 feet wide on the west side and about 40 feet wide on the east side, it was necessary to carry the foundation of the new walls 6 feet below city base at the ends, sloping to 30 feet below at the faces of wharves. Heavy tongued and grooved sheeting, 8 inches in thickness, was driven, however, to a depth of 18 feet in front of the old walls, on both sides, to prevent any disturbance of the filling under or back of these walls during the construction of the new wall. The bottom of the dock on the line of the wall was dredged to 32 feet below city base, for a width sufficient to maintain a trench 15 feet wide during the driving of the piles. Spruce piles were then driven in the same manner as those in the foundation for the bridge. The piles were driven in alternate rows of six and seven piles each, the rows being 15 inches on centers and the piles in adjoining rows being staggered. All except the four back piles in each row were driven at an inclination of 1 in 12. Seven hundred and fifty-five piles were driven for the concrete foundation of the wall. For the main portion of the wall the width of the foundation between elevation minus 30 and elevation minus 15 is 15 feet; at the latter elevation it steps back to a width of 10 feet and continues at this width to city base. The mold for holding the concrete was made of 6-inch hard pine tongued and grooved sheeting at both

front and back, and was carried up to 5 feet above city base for the purpose of construction, but finally cut off at about low water on the completion of the work. When the concrete had reached about elevation minus 17, a line of 4-inch hard pine sheeting was placed at the back to hold the concrete of the upper part of the foundation. The Portland cement concrete was of the same proportion and deposited in the same manner as that at the piers of the bridge, and was carried up to elevation 0 city base. The sheeting at the front of the wall was anchored at the top by 1-inch rods screwed into each alternate piece of sheeting and bent down into the concrete.

The wall above the foundation is coursed granite ashlar masonry, laid solid in cement mortar and backed with boulder concrete; its width at the foundation is 9 feet 3 inches and the back is carried vertically to elevation 3.5 to form a step to receive the anchor of the relieving platform. Above this step the wall is 6 feet 6 inches wide and narrows to a width of 3 feet under the coping at elevation 15. The coping is 2 feet deep and 2 feet 6 inches wide, pean-hammered on top, quarry-faced in front and dressed for  $\frac{3}{8}$ -inch joints. It is doweled to course below and further secured by galvanized wrought-iron cramps at each joint.

Back of the wall a relieving platform was built 40 feet wide, supported on spruce piles. The piles were especially long, ranging from 50 feet in length near the wall to 35 feet in length at the rear and were carefully driven in rows 3 feet on centers and spaced 2 feet 6 inches in the rows, the total number driven being 941. They were capped with 10-inch by 10-inch hard pine caps, carefully fitted and secured to each pile by  $1\frac{1}{2}$ -inch diameter oak treenails, 16 inches long, the caps being covered with 4-inch spruce plank forming a platform, at elevation 3 feet above city base, for supporting the filling back of the wall. The caps were designed to serve as a tie to anchor the wall to a line of batter piles driven at the rear of the platform. Batter piles were driven between the rows of bearing piles of the platform at an inclination to the perpendicular of 1 to 2, and capped with a special 10-inch hard pine cap which was notched into the caps of the platform and securely fastened. At the wall end these caps were built into the concrete 18 inches and secured by two  $1\frac{1}{2}$ -inch diameter pins in each cap; these projected 7



inches beyond the ends of the caps into the concrete. Before the planking was placed, the filling under the platform was deposited very carefully at a uniform slope of 2 horizontal to 1 vertical, extending from the under surface of the platform at its rear until it reached the back of the foundation of the wall.

The filling was of good clean gravel, ashes or other materials, free from clay, silt or organic matter. After the wall was completed and ballasted good clean filling was deposited on the platform and in the portion of the old dock between the rear of the platform and the old wall, the material above elevation 14 being clean dredged gravel with no stones larger than 3 inches in diameter. A board fence having 1½-inch square iron posts leaded into the coping was built for the full length of the wall at the head of the dock.

The designs for the walls at the heads of docks Nos. 2 and 3 and the bulkhead connecting them received the approval of the Harbor and Land Commissioners on May 1, 1908. Because of the fact that the distance between the old wall at the head of dock No. 2 and the new wall was much less than at dock No. 1, and because of arrangements made with the railroad company by which the foundation was not carried down so far as at dock No. 1 and was permitted to project 7 feet outside the street line, it was not deemed necessary to provide a relieving platform for this wall; in all other respects the designs were very similar. The wall as built is 217 feet long measured on the street line, the westerly end connecting with the old side wall of the dock. As there was a timber wharf 45 feet wide in front of the old wall the same form of construction was used as at dock No. 1.

The bottom of dock No. 2 at the location of the wall was dredged to 27 feet below city base, for such width as was necessary to maintain a trench 22 feet wide during the driving of the piles. The piles were driven the same as at the other wall, and in rows of 8 piles each, the rows being 2 feet 3 inches on centers, the two front piles being driven at an inclination of 1 in 6, the others being driven vertically; the tops of inclined piles were left at elevation minus 22 and the others at minus 15. A total of 711 piles were driven in the foundation of the wall, no pile being less than 35 feet long when left in place. Tongued and grooved 6-inch hard pine sheeting was driven at an inclination of 1 in 6 to form a mold

for the concrete foundation at the front, and as originally designed no sheeting was to be provided at the back until elevation minus 11 should be reached, the concrete to be deposited without a mold below this grade. Owing to the fact that a portion of the old wall became undermined by the waves during a heavy storm and slid out into the trench dredged for the concrete, the design was slightly changed, 6-inch sheeting being driven at the back of the foundation the same as at the front. As built, the foundation consists of clean gravel deposited in a trench leaving a finished surface sloping uniformly at the rate of 2 horizontal to 1 vertical from elevation minus 25 at the front to elevation minus 15 at the back, and on this surface the concrete of the wall rests.

The widths of the foundation at minus 25 and minus 15 are respectively 22 feet and  $18\frac{1}{2}$  feet. The concrete used was of the same quality and deposited in the same manner as at dock No. 1. At elevation 0 city base, where the foundation is 10 feet wide, the granite masonry wall begins and is carried up to elevation 15. The wall proper is 9 feet  $1\frac{1}{2}$  inches wide at base and 4 feet at top, built of coursed granite laid solid in cement mortar and backed with cement concrete, the quality of workmanship and materials being the same as at dock No. 1. At three locations in the front of the wall the granite face projects out 18 inches beyond the general face of the wall for lengths of 18 feet, forming buttresses on which are to rest the steel posts for supporting the grain conveyor of the railroad company, long rods being built into these buttresses for anchors for the posts. It was in consequence of providing these buttresses that permission was given by the railroad company to build the foundations outside the street line. The wall carries a concrete parapet 14 inches wide and 21 inches high, which forms the back of the sidewalk and supports a board fence.

The design for the wall at the head of dock No. 3 was substantially the same as the old walls built at these docks, the only essential difference being the substitution of a concrete cap for a plank grillage or granite levelers resting directly on the pile heads. The wall is 171 feet long, 9 feet 6 inches thick at city base and 4 feet 6 inches thick at the top, which is at elevation 14. It is built of good quality granite quarry stone laid dry, without pinnars on the face, and no open joints of more

than 2 inches. The concrete cap is 2 feet deep and 11 feet 6 inches wide, resting on rows of spruce piles spaced 2 feet 6 inches on centers, five piles in each row, the two front piles being driven on an inclination of one in six. A concrete parapet and a board fence of same design as at dock No. 2 are built on top of the wall for the entire length, except where provision is made for the railroad track leading to a landing bridge.

Across the end of the location of the proposed pier No. 3, between the walls built at docks No. 2 and No. 3, a timber bulkhead was built 184 feet long. The surface of the ground was practically at city base, and the cap of the bulkhead at about  $16\frac{1}{2}$  feet above city base. The bulkhead consists of a spruce pile and a spurshore spaced every 9 feet, with two lines of double 6-inch by 12-inch hard pine wales bolted to the piles, one at 4 feet 6 inches above the surface of the ground and the other within 14 inches of the top of the bulkhead; between these double wale pieces 6-inch hard pine, tongued and grooved sheeting was driven to a depth of 5 feet below the surface and securely bolted to the upper wale pieces by  $\frac{7}{8}$ -inch diameter screw bolts, one in each alternate piece of sheeting, and to the lower wale pieces by  $\frac{3}{4}$ -inch spike bolts, one in each piece. A 12-inch by 14-inch hard pine timber was fitted to the top of the bulkhead and securely bolted, forming a cap to which a board fence, of same design as those on the walls, was attached. The bulkhead was anchored back into the filling by  $1\frac{3}{4}$ -inch diameter rods spaced  $4\frac{1}{2}$  feet on centers and secured to anchors made of 3-inch hard pine plank set vertically in the filling and located about 21 feet back from the face of the bulkhead.

The act authorizing the building of the avenue reserved to the railroad company "the right to lay and operate at grade two tracks along and others across the land owned by them included within said Northern avenue and two tracks diagonally across Sleeper street," and the Railroad Commissioners were given authority to determine the location of the tracks and to regulate the highway traffic and travel on the avenue and street. Under date of December 16, 1908, the commissioners approved the location of tracks shown on a plan dated May 14, 1908, and determined the manner of constructing and operating the railroad tracks. The railroad company did not build the two longitudinal tracks for the entire length of the avenue, east of Sleeper street,

as it was authorized to do. It built a single track from the harbor line on the South Boston side of the channel across the end of Sleeper street, then a double track along the avenue as far as pier No. 1, then by a curve to the right joined the old tracks on the southerly line of the avenue. It also built all the cross tracks approved by the commissioners, two across Sleeper street and fifteen across Northern avenue, one of the latter being across span 3 of the bridge over Fort Point channel. The track construction determined by the commissioners required steel girder rails 9 inches deep laid on cross-ties and secured by tie rods. The top of the rail coincided with the finished surface of the street. The granite pavement between the rails and 18 inches outside each rail was required by the commissioners to be laid by the railroad company, the blocks and methods of laying being the same as used by the city in paving the remainder of the street.

The filling required to raise the new street at the end near the channel was done by the railroad company under contract with the city, gravel being brought in by train and the tracks raised as the filling progressed. The cross section of the street provides a single sidewalk 8 feet wide on the water or northerly side of the avenue, paved with brick and having granite edgestone; the rest of the street, 82 feet in width, was paved with granite blocks having gravel joints. At the southerly side line of the street the paving was dished, forming a gutter about 3 feet wide, across which easy access may be had to the railroad freight yards at any desired point.

Surface drains with necessary catch-basins on both sides of the street have been provided for the entire length of the new street, the discharge in all cases being into tide water.

Two lines of water pipe, 16-inch and 20-inch, were laid by the Water Department on the northerly side of the avenue and hydrants set in the sidewalks at proper intervals.

#### RAINSFORD ISLAND, WHARF AND BULKHEAD.

The storm of December 26, 1909, destroyed the bridge connecting the shore with the head of the wharf, on which the coal shed stands and badly damaged the bulkhead on the northerly side of the island and washed away much of the filling and road surface. The trustees made contracts with W. H. Ellis for rebuilding the

bridge for \$3,300 and for repairing the bulkhead and furnishing fifteen fender piles in the head of the wharf, at a cost of \$2,005.85. The work was supervised by this department and was completed January 31, 1910.

#### WESTERN AVENUE BRIDGE TO CAMBRIDGE.

Plans and specifications were made for repairing this bridge and the Commissioners for the Boston and Cambridge Bridges made a contract December 8, 1909, with W. H. Ellis, the lowest bidder, for doing the work. The draw is to be rebuilt; the roadway is to be uncovered and the stringers examined, and new stringers will be put in where required, and the entire bridge will be replanked. Work was begun December 14, when the bridge was closed to team travel until the draw and approaches should be completed. A temporary bridge was erected across the channel to accommodate foot travel. About 40 per cent of the work has been done.

#### WHARF AND PIER FOR FIREBOAT.

Plans and specifications were made at the request of the Fire Commissioner for building a wharf and pier for the fireboat, near the East Boston landing of the South Ferry. The work was awarded to George T. Rendle, the lowest bidder, for \$3,500, and included dredging the dock to grade — 15 city base; the entire work was completed May 24, 1909.

#### 1909.—STREETS.

Preliminary surveys and plans were made; working plans and specifications prepared and forwarded to the Street Department for the construction of twenty-eight assessment streets, for repaving thirty-nine streets, and for constructing artificial stone sidewalks in eighteen streets; surveys have been made, levels taken and preliminary plans prepared for twenty assessment streets and for repaving ten streets; the necessary surveys were made and grades for street railway tracks determined in twenty-seven streets.

Preliminary estimates have been made of the cost of repaving thirty-four streets and for constructing forty-eight streets.

Record plans are now being made of the work done during the year. The street book, giving the lengths and areas of pavements in accepted streets and public

alleys, has been corrected to February 1, 1909, and is now being brought up to February 1, 1910.

### WATERWORKS.

The past year saw the completion of the improved low service supply for South Boston, work on which began in 1904 when the tunnel was built under Fort Point channel at the draw on Congress street. In this connection the following work was done during the past year: The 30-inch main in C street, South Boston, was extended in C street, C Street Extension, Northern avenue and Sleeper street to a junction with the 24-inch main in Congress street, a total distance of about 5,750 feet; the 30-inch main in Congress street, City Proper, was extended from Atlantic avenue to Fort Point channel; 24-inch pipe was laid on the trestles built in 1907 over Fort Point channel from the ends of the tunnel to the Boston and South Boston shores, and connection was made with the 30-inch pipe previously laid in the tunnel, thus completing the line between the City Proper and South Boston. At the same time 16-inch high service pipe was laid on the trestles and connected with the 20-inch high service pipe in the tunnel in anticipation of future extension of this service. This new low service line both greatly strengthens the supply to South Boston and affords a new "feed" for the city proper.

The Deacon meters were operated to detect waste, from April 8 until November 24, in the residential districts of the City Proper, in Charlestown, South Boston, Roxbury and Jamaica Plain; the saving of water effected was approximately two and one-half million gallons per day, or about four gallons per capita for the entire population of the city. The cost of the work was \$3,546. Of the waste found, 1,720,000 gallons per day was in service pipes in the streets; 430,000 gallons per day in broken main pipe; 206,000 gallons per day in defective joints in main pipe, and about the same amount in hydrants and watering posts. The result represents a part only of the waste existing in the territory tested, as no inspection was made inside of buildings, while the outside inspection was incomplete, the larger leaks only and those most easily found being located. Although the saving made was comparatively small yet it is an earnest of what might be accomplished in restricting waste if the Deacon meter



readings were followed up by thorough inspection both outside and inside of buildings. The meter simply locates waste within certain limits and measures its amount; to definitely locate that waste is the duty of the inspector, a duty demanding honest and intelligent work.

On January 3 of this year a break occurred in the easterly 30-inch main in Tremont street, opposite Seaver place, with a large resulting damage to property in the vicinity. The cause of the break was the rigid bearing of the pipe at one point upon the concrete reinforcement of a pipe sewer built by the Transit Commission in 1897 immediately outside of the wall of the subway and directly under the water pipe; the sewer was rigidly supported upon piers extending down to the bottom of the side wall of the subway, and was evidently designed with a safe clearance between its concrete covering and the bottom of the pipe; where the break occurred this design had not been followed, the concrete being found hard up against the pipe for a distance of about six inches. The pipe, laid in 1847, was found to be in excellent condition, practically the only deterioration discovered being on the inside under the tubercles. The following is an analysis of the metal:

Silicon . . . . .	1.70
Sulphur . . . . .	0.094
Manganese . . . . .	0.82
Phosphorus . . . . .	0.79
Combined Carbon . . . . .	0.60
Graphitic Carbon . . . . .	2.98

This is the eighth break which has occurred in the large water pipes in Tremont street, between Boylston and Common streets, since the construction of the subway under them. The apparent cause in each case was identical with that of the recent break, viz., a rigid bearing at one point with opportunity for a slight settlement in the adjacent pipes.

The following is a memorandum of the breaks that have occurred, with a statement of the condition found in each case:

1897, May 12. Easterly, 30-inch main opposite Common street. Rigid bearing on subway roof.

1898, August 11. Westerly, 30-inch main opposite Common street. Rigid bearing on manhole over subway.

1899, September 1. Easterly, 30-inch main opposite Common street. Rigid bearing on subway roof.

1900, August 8. Easterly, 30-inch main at Hotel Touraine. Rigid bearing on subway wall.



1900, September 5. Easterly, 30-inch main at Hollis street. Rigid bearing on wooden post supported from subway roof.

1904, March 23. Westerly, 30-inch main opposite Common street. Rigid bearing on subway roof.

1907, May 13. 16-inch main at Hollis street. Rigid bearing on subway roof.

1910, January 3. Easterly, 30-inch main opposite Seaver place. Rigid bearing on concrete over sewer.

A gauge has been installed in the office of the Engineering Department in City Hall which registers the pressure in the low service system at a point about 1,200 feet distant; it has not been possible heretofore to obtain such a record, the City Hall being situated in the high service area. The operating mechanism of the gauge is located in the basement of the Post Office, and consists of a diaphragm connected with the low service main in Milk street by a small pipe, a lever and transmitter; the varying pressure on the main is electrically registered at City Hall, where it is both indicated on a dial and recorded in permanent form on a chart.

I renew the following recommendations made in last year's report, viz., that a standpipe be built on the northerly portion of the "double-high" system in West Roxbury, and that additional storage be provided at Mt. Bellevue on the same service. That a storage reservoir or reservoirs be built on the high service system large enough to hold at least six days' supply for the entire high service of the city. That a tunnel be built under the Charles river at Warren Bridge to insure a safe connection between the large mains in Boston and Charlestown and to safeguard the high service supply of Charlestown.

#### MISCELLANEOUS.

Examinations and reports have been made in reference to the southwesterly line of the Granary Burial Ground, the fences at the Bunker Hill Street Cemetery, the Marine Park pier head, the North End Park piers and the Thomas Park monument. A plan and specifications were prepared for a bulkhead at a vacant lot on Northampton street, between Tremont street and Columbus avenue.

Respectfully submitted,

WILLIAM JACKSON,  
*City Engineer.*

## Monthly Rainfall in Inches during 1909 in Various Places in Eastern Massachusetts.

PLACES.	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.	Total.
Framingham.....	4.14	5.77	4.07	4.53	2.31	2.89	1.63	2.82	4.55	1.09	3.24	3.94	40.98
Dam 4, Ashland.....	3.98	5.75	4.30	4.59	2.34	3.21	1.24	2.74	4.59	1.13	3.38	4.01	41.26
Cordaville.....	3.86	6.03	4.47	4.95	2.73	2.53	1.74	3.35	4.91	1.25	3.50	4.21	43.53
Lake Cochituate.....	4.34	5.66	3.98	4.50	2.05	3.09	1.73	2.84	4.33	1.06	3.76	4.10	41.44
Chestnut Hill Reservoir.....	4.79	5.61	4.27	4.53	2.44	4.12	1.10	4.11	5.79	1.58	4.89	4.39	47.62
Spot Pond.....	4.04	5.31	3.80	4.23	1.96	4.27	2.27	3.53	5.12	1.28	4.31	3.95	44.07
Cambridge Observatory.....	4.62	5.22	3.90	3.90	2.01	3.82	1.62	3.19	5.54	1.12	3.99	4.92	43.85
Waltham, Boston Manufacturing Company.....	3.22	5.56	4.14	4.11	2.29	3.26	2.05	3.43	5.47	1.08	4.04	.....	.....
Lowell, Locks & Canals Company.....	4.17	5.79	3.51	5.53	3.11	2.13	2.52	2.46	4.21	1.20	2.65	4.08	41.36
Main Drainage Yard, 795 Massachusetts avenue.....	4.58	4.99	3.79	4.21	2.23	3.78	0.86	3.41	5.67	1.18	2.72	3.60	41.02
Average of above ten places.....	4.17	5.57	4.02	4.51	2.35	3.31	1.68	3.19	5.02	1.20	3.65	4.13	42.79

Average Monthly Heights, in Feet, Above Boston City Base, to which Water Rose at Different Stations on the Boston Waterworks.

1909.	SOUTHERN HIGH SERVICE.																NORTHERN HIGH SERVICE.			
	City Hall.		Engine House No. 24, Quincy and Warren Streets, Roxbury.		Engine House No. 20, Walnut Street, Neponset.		Engine House No. 19, Norfolk Street, Mattapan.		Engine House No. 28, Centre, near Green Street, Jamaica Plain.		Engine House No. 30, Centre, near Bellevue Street, West Roxbury.		Engine House No. 45, Washington and Poplar Streets, Roslindale.		Engine House No. 29, Chestnut Hill Avenue, Brighton.		Engine House No. 32, Baker Hill Street, Charlestown.		Engine House No. 5, Marion Street, East Boston.	
	3 a. m.	9 a. m.	3 a. m.	9 a. m.	3 a. m.	9 a. m.	3 a. m.	9 a. m.	3 a. m.	9 a. m.	3 a. m.	9 a. m.	3 a. m.	9 a. m.	3 a. m.	9 a. m.	3 a. m.	9 a. m.	3 a. m.	9 a. m.
January	246	233	243	231	241	229	246	239	248	242	.....	.....	.....	.....	247	244	162	158	150	139
February	246	233	243	231	241	228	246	239	248	242	.....	.....	.....	.....	247	243	162	157	150	139
March	246	233	243	230	241	228	246	238	248	242	.....	.....	.....	.....	247	243	161	155	153	142
April	246	231	242	229	241	227	244	237	247	241	247	238	.....	.....	246	244	162	159	154	144
May	246	231	242	229	242	227	245	236	248	241	247	238	246	238	246	242	163	158	156	144
June	247	232	244	231	244	227	246	235	248	240	247	238	247	238	246	243	165	159	156	144
July	247	232	247	234	244	229	246	237	248	241	247	238	246	238	245	242	163	156	155	142
August	247	234	248	237	245	231	247	239	248	242	247	239	246	239	245	242	164	158	156	144
September	247	233	249	237	245	232	247	239	248	242	247	239	247	240	247	243	163	157	156	144
October	248	234	250	239	246	233	248	239	249	243	247	240	249	240	247	244	163	156	156	144
November	248	236	250	240	246	234	248	240	249	244	248	240	249	241	247	241	162	156	156	145
December	247	237	249	240	245	234	247	241	248	244	247	241	247	242	246	244	162	156	154	144

Average Monthly Heights, in Feet, Above Boston City Base, to which Water Rose at Different Stations on the Boston Waterworks.

1909.	LOW SERVICE.																	
	Chestnut Hill Pumping Station, Brighton.		Engine House No. 34, Western Avenue, Brighton.		Boston Common.		Engine House No. 8, Salem Street, City Proper.		Engine House No. 7, East Street, City Proper.		Engine House No. 38, Congress and Faneuorth Streets, South Boston.		Engine House No. 2, Fourth and O Streets, South Boston.		Water Department Yard, 710 Albany Street, Roxbury.		Water Department Yard, Gibson Street, Dorchester.	
	3 a. m.	9 a. m.	3 a. m.	9 a. m.	3 a. m.	9 a. m.	3 a. m.	9 a. m.	3 a. m.	9 a. m.	3 a. m.	9 a. m.	3 a. m.	9 a. m.	3 a. m.	9 a. m.	3 a. m.	9 a. m.
January	141	165	134	136	131	125	126	118	128	121	122	113	122	112	125	119	122	113
February	141	166	133	134	131	120	126	113	127	118	121	109	123	109	125	115	124	111
March	141	165	132	134	133	127	129	121	132	124	127	118	130	119	130	124	130	120
April	141	166	131	132	134	127	131	121	133	125	128	119	132	120	130	125	130	120
May	141	165	132	132	137	129	132	124	136	128	131	120	133	121	132	128	132	122
June	140	165	132	133	137	129	133	124	136	127	131	120	133	120	133	127	131	122
July	141	166	135	136	137	130	133	126	136	128	131	121	133	121	133	129	132	123
August	144	166	141	139	142	133	138	127	140	131	134	123	136	124	137	132	135	126
September	141	160	139	138	140	134	139	129	139	132	133	124	135	125	141	137	135	126
October	142	158	140	143	141	136	140	130	142	135	135	126	138	127	143	139	137	128
November	145	157	144	141	145	136	141	131	145	135	138	125	141	128	147	138	140	128
December	141	158	139	141	140	135	136	130	139	134	132	124	134	126	141	139	133	127



## INDIVIDUAL TIME REPORT

(TO BE SENT TO THE SUPERVISOR OF YOUR PROJECT)  
ON THE LAST DAY OF YOUR WORK PERIOD

PROJECT No. \_\_\_\_\_ Group No. \_\_\_\_\_

PERIOD FROM \_\_\_\_\_ 1938 TO \_\_\_\_\_ 1938 INCLUSIVE

NAME OF EMPLOYEE \_\_\_\_\_ I.D. No. \_\_\_\_\_ Sex \_\_\_\_\_ M or F

MAILING ADDRESS \_\_\_\_\_

OCCUPATION \_\_\_\_\_ CLASSIFICATION \_\_\_\_\_

## NUMBER OF HOURS WORKED EACH DAY

DATE												
	HOURS											

CERTIFICATE: I HEREBY CERTIFY THAT I  
HAVE WORKED THE HOURS  
INDICATED ABOVE IN ACCORD-  
ANCE WITH WPA REGULATIONS.

APPROVED: \_\_\_\_\_

SUPERVISOR

SIGNATURE OF WORKER



## GENERAL STATISTICS.

## BOSTON WATER DEPARTMENT.

Daily average amount used during 1909 (gallons) . . .	94,029,900
Daily average amount used through meters during 1909 (gallons) . . .	22,768,700
Number of services February 1, 1910 . . . . .	97,194
Number of meters in service February 1, 1910 . . . .	12,048
Number of motors under supervision February 1, 1910 .	117
Number of elevators under supervision February 1, 1910,	583
Length of supply and distributing mains in miles February 1, 1910 . . . . .	761.2
Number of public hydrants in use February 1, 1910 . .	8,024
Yearly revenue from annual water rates (assessed) . .	\$1,411,156.63
Yearly revenue from metered water (assessed) . . . .	*\$1,285,477.63
Percentage of total revenue from metered water . . .	47.7
Yearly expense of maintenance . . . . .	\$654,493.49

\* No revenue of any amount was received from the new meters set during the year 1909, all of the services metered during 1909 being assessed on the annual rate. The number of meters from which this revenue was derived were 5,500.



CITY ENGINEERS,  
1850-1910.

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E. H. CHESBROUGH, M. Am. Soc. C. E.,  
November 18, 1850, to October, 1855.  
(Died August 18, 1886.)

JAMES SLADE,  
October 1, 1855, to April 1, 1863.  
(Died August 25, 1882.)

N. HENRY CRAFTS,  
April 1, 1863, to November 25, 1872.  
(Died June 14, 1908.)

JOSEPH P. DAVIS, M. Am. Soc. C. E.,  
November 25, 1872, to March 20, 1880.  
(Resigned March 20, 1880.)

HENRY M. WIGHTMAN, M. Am. Soc. C. E.,  
April 5, 1880, to April 3, 1885.  
(Died April 3, 1885.)

WILLIAM JACKSON, M. Am. Soc. C. E.,  
April 21, 1885, to the present time.

APPENDICES.

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APPENDIX A.— Table Showing the Widths of Openings for Vessels in all Bridges Provided with Draws in the City of Boston, January, 1910.

APPENDIX B.— Engineering Department Property Schedule.

APPENDIX C.— Elevations and Datum Planes Referred to Boston City Base.

APPENDIX D.— Engineering Department Annual Reports, 1867–1910.

APPENDIX E.— Engineering Department, Revised Ordinances.

APPENDIX F.— Meridian Line.

APPENDIX G.— Atlantic Avenue Extension; History of Legislation and Official Action.

## APPENDIX A.

WIDTHS OF OPENINGS FOR VESSELS IN ALL BRIDGES PROVIDED WITH DRAWS IN THE CITY OF BOSTON, JANUARY, 1910.

NAME OF BRIDGE.	LOCATION.	NUMBER OF OPENINGS.	WIDTH.	
			Feet.	Inches.
Atlantic Avenue.....	Over Fort Point channel.....	1	42	6
Boston & Maine R. R., Eastern Division.....	Boston to East Cambridge.....	1	39	8
" " " " " "	Over Miller's river.....	1	35	10
" " " " " "	Boston to Charlestown.....	1	36	7
" " " " " "	" " " " " "	1	36	7
" " " " " "	Boston to East Cambridge.....	1	39	10
" " " " " "	" " " " " "	1	39	8
" " " " " "	" " " " " "	1	39	8
" " " " " "	Over Miller's river.....	1	36	0
Broadway.....	Over Fort Point channel.....	1	42	7
* Brookline Street.....	Brighton to Cambridge.....	1	40	0
* Cambridge.....	Boston to Cambridge.....	1	50	0
Cambridge Street.....	Brighton to Cambridge.....	1	36	4
Canal.....	Boston to East Cambridge.....	1	36	0
Charles River Dam.....	Boston to East Cambridge.....	1	45	0
Charlestown (main channel).....	Boston to Charlestown.....	2	50	0
" (north channel).....	" " " " " "	.....	49	9
Chelsea (south channel).....	Charlestown to Chelsea.....	1	38	9
" (north channel).....	" " " " " "	1	60	0
Chelsea Street.....	East Boston to Chelsea.....	1	60	0

Commercial Point.....	Dorchester.....	1	24	2
Congress Street.....	Over Fort ".....	1	50	0
Dorchester Avenue.....	".....	1	41	4
Dover Street.....	".....	1	40	0
Grand Junction R. R. ".....	Brighton to Cambridge.....	1	39	0
Granite.....	East Boston to Chelsea.....	1	60	0
Harvard (Boston side).....	Dorchester to Milton.....	1	36	0
" (Cambridge side).....	Boston to Cambridge.....	2	36	6
L Street.....	".....	.....	36	10
Malden.....	Over Reserved channel, South Boston.....	1	39	8
Meridian Street (East Boston side).....	Charlestown to Everett.....	1	50	0
" (Chelsea side).....	East Boston to Chelsea.....	2	59	2
Neponset.....	".....	.....	59	2
N. Y., N. H. & H. R. R. ".....	Dorchester to Quincy.....	1	36	0
" " " Y-connection.....	Over Fort Point channel.....	1	41	9
" " " Old Colony Division.....	".....	1	42	0
North Beacon Street.....	Dorchester to Quincy.....	1	51	0
North Harvard Street.....	Brighton to Watertown.....	1	30	0
Northern Avenue (Boston side).....	Brighton to Cambridge.....	1	36	0
" (South Boston side).....	Over Fort Point channel.....	2	75	0
Prison Point.....	".....	.....	75	0
Summer Street.....	Charlestown to Cambridge.....	1	37	6
Warren.....	Over Fort Point channel.....	1	50	0
Western Avenue.....	Boston to Charlestown.....	1	36	0
".....	Brighton to Cambridge.....	1	36	0
".....	Brighton to Watertown.....	1	36	0

\* Drawless opening; clear headroom of 26 feet at mean high water.

## APPENDIX B.

## ENGINEERING DEPARTMENT PROPERTY SCHEDULE, MAIN OFFICE.

1 horse.	16,044 plans engineering works,
2 carriages.	loose.
1 automobile.	14 volumes plans engineering works,
1 sleigh.	bound.
2 harnesses.	Photographs of engineering works.
3 robes.	1 mercurial barometer.
Instruments for drawing.	1 aneroid barometer.
Instruments for surveying, as fol-	1 holstetric barometer.
lows:	1 set hydrometers.
2 Temple transits.	1 hygrometer.
7 Buff & Berger transits.	1 pair field glasses.
1 Berger & Sons transit.	3 typewriters.
1 P. & R. Wittstock transit.	2 dynamometers.
8 Gurley transits.	1 pantagraph.
1 Keuffel & Esser level.	3 calculating machines.
2 Temple levels.	1 volt meter.
4 Buff & Berger levels.	1 comptometer.
7 Gurley levels.	2 thermophones.
13 Boston rods.	2 cameras.
4 New York rods.	3 planimeters.
10 Troy rods.	1 Bourdon pressure gauge.
4 Philadelphia rods.	1 Burroughs arithmometer.
Apparatus for blueprinting.	1 Steiger calculating machine.
Cases for plans and books.	1 Egli calculating machine.
Reference library, 1,572 volumes.	

## SURVEYING DIVISION.

2 Temple transits.	18 Boston rods.
2 Moody transits.	1 Troy rod.
2 Buff & Berger transits.	8 iron rods.
4 Berger & Sons transits.	34,948 plans.
1 Buff & Buff transit.	3,563 lithographed maps.
1 Stackpole transit.	1 pantagraph.
1 Troughton & Sims transit.	3 planimeters.
1 P. & R. Wittstock transit.	1 Federal blueprinting machine,
7 Buff & Berger levels.	No. 10.
1 Moody level.	

## APPENDIX C.

## ELEVATIONS AND DATUM PLANES REFERRED TO BOSTON CITY BASE.

Feet.

- \* 0.00 Boston city base. This base is used by the towns of Brookline and Watertown and the cities of Chelsea, Everett, Malden, Newton and Waltham.
- 4.98 Cambridge city base.
- +0.64 Somerville city base.
- 0.00 Metropolitan Park Commission base.
- +0.60 Harbor and Land Commission base.
- 0.00 Metropolitan Water Board base.
- 100.00 Metropolitan Sewerage Board base.
- 100.00 Boston Transit Commission base.
- 100.00 Charles River Commission base.
- 15.62 Highest recorded tide, April 16, 1851. Charles Harris, Level Book 22 (15.10 above mean low water, United States Coast Survey Chart of Boston Harbor, 1857).
- 15.45 Old bench mark on coping of old dry dock at Charlestown Navy Yard.
- 15.11 New bench mark on coping of old dry dock at Charlestown Navy Yard, northwest end over crowfoot.
- 5.00 Piles to be cut off for buildings.
- 12.00 Minimum cellar bottom grade.
- 9.82 South Boston base. Formerly in use, now abandoned.
- 99.40 Charles river flood elevation, at the Brookline pumping station, February 13, 1886.
- 97.50 Charles river flood elevation, March, 1902.
- 95.66 Charles river average flood elevation, 1886 to 1902, both inclusive.
- 0.00 Mean low water about 1830.†
- +0.34 Mean low water, 1867.†
- +0.79 Mean low water, 1902.†
- +0.58 Navy yard base, 1902.†
- 10.63 Mean high water, 1902.†
- 5.71 Mean sea level, 1902.†
- 9.84 Mean rise and fall of tide, 1902.†

\* Definition of Boston city base: "Boston city base is a datum plane 15 feet above the average height of the sill of the Charlestown dry dock." (Page 552, report of Committee on Charles River Dam, 1903.)

† John R. Freeman, civil engineer, in report to Committee on Charles River Dam, 1903, pp. 562, 569, 570.

The following tidal records may be of interest:

*High Tides.*

[Plane of Reference, Boston City Base.]

FEET.	Date.	Where Taken.	By Whom.
15.62	April 16, 1851	Average of 7 observations. ....	Charles Harris.
15.74	April 16, 1851	Navy Yard, staff gauge. ....	Isaac Williams.
14.94	Nov. 27, 1898	Average of 15 observations.	
13.72	Nov. 8, 1900	Malden Bridge. ....	F. P. Spalding.
14.19	Nov. 25, 1901	Average of 10 observations.	
13.60	Dec. 14, 1902	Average of 11 observations.	
13.00	Feb. 17, 1903	North Ferry, Boston. ....	J. H. Edmonds.
13.40	Jan. 14, 1904	North Ferry, Boston. ....	J. H. Edmonds.
14.83	Jan. 25, 1905	Average of 34 observations.	
14.70	Jan. 25, 1905	Inner harbor, 10 observations.	
13.50	Nov. 15, 1906	Neponset Bridge. ....	M. F. Toomey.
13.00	April 9, 1907	North Ferry, Boston. ....	J. H. Edmonds.
13.10	Nov. 24, 1909	North Ferry, Boston. ....	J. H. Edmonds.
13.35	Nov. 25, 1909	North Ferry, Boston. ....	J. H. Edmonds.
13.10	Nov. 27, 1909	North Ferry, Boston. ....	J. H. Edmonds.
13.00	Nov. 28, 1909	North Ferry, Boston. ....	J. H. Edmonds.
15.64	Dec. 26, 1909	Average of below, omitting Granite Bridge.	
15.70	Dec. 26, 1909	Nut Island, Metropolitan sewer station. ....	S. R. Gauge.
15.75	Dec. 26, 1909	Moon Island, main drainage works. ....	S. R. Gauge.
15.94	Dec. 26, 1909	Granite Bridge, Dorchester, tide mark. ....	A. N. Colman.
15.79	Dec. 26, 1909	Neponset avenue, No. 451, tide mark. ....	J. H. Edmonds.†
15.82	Dec. 26, 1909	Neponset Bridge, tide mark. ....	F. P. Spalding.
15.85	Dec. 26, 1909	Neponset, Pratt's lumber yard. ....	Augustus Dennison.
15.85	Dec. 26, 1909	Old Colony Yacht Club, Savin Hill. ....	Gustav Holmberg.
15.60	Dec. 26, 1909	L Street Bridge, South Boston. ....	D. J. Lane.
15.65	Dec. 26, 1909	Northern Avenue Bridge. ....	J. E. Murray.
15.63	Dec. 26, 1909	Summer Street Bridge. ....	J. F. Kinnaly.
15.50	Dec. 26, 1909	Mt. Washington avenue, tide mark. ....	J. H. Edmonds.
15.58	Dec. 26, 1909	Roxbury canal at Massachusetts avenue, tide mark. ....	J. H. Edmonds.
15.64	Dec. 26, 1909	Long Wharf. ....	H. S. Adams.
15.64	Dec. 26, 1909	South Ferry, Boston, tide mark. ....	J. H. Edmonds.
*15.50	Dec. 26, 1909	North Ferry, Boston. ....	J. H. Edmonds.
15.50	Dec. 26, 1909	Charlestown Bridge. ....	H. A. Bolan.

\* The observation at the North Ferry, Boston, was an actual reading made at high water on a staff gauge reading in tenths.

† The elevations of the tide of December 26, 1909, have been compiled by J. H. Edmonds principally from points put in by him for that purpose when in the Surveying Division.



HIGH TIDES.—*Concluded.*

FEET.	Date.	Where Taken.	By Whom.
15.60	Dec. 26, 1909	Charles River Dam . . . . .	C. R. D. Comm.
15.62	Dec. 26, 1909	Navy Yard . . . . .	S. R. Gauge.
15.58	Dec. 26, 1909	Chelsea (South) Bridge . . . . .	James Gallagher.
15.70	Dec. 26, 1909	Malden Bridge . . . . .	H. H. McNerlin.
15.50	Dec. 26, 1909	Meridian Street Bridge . . . . .	Daniel McFarland.
15.54	Dec. 26, 1909	North Ferry, East Boston, tide mark . . . . .	J. H. Edmonds.
15.74	Dec. 26, 1909	South Ferry, East Boston, tide mark . . . . .	J. H. Edmonds.
15.72	Dec. 26, 1909	Fireboat station, East Boston . . . . .	W. J. Marshall.
15.65	Dec. 26, 1909	Boston, Revere Beach & Lynn Railroad Station, East Boston, tide mark . . . . .	J. H. Edmonds.
15.75	Dec. 26, 1909	Jeffries Point, East Boston . . . . .	A. A. Martin.
15.75	Dec. 26, 1909	Orient Heights Yacht Club, tide mark . . . . .	J. H. Edmonds.
15.60	Dec. 26, 1909	Winthrop Bridge, East Boston . . . . .	J. F. Donovan.
15.70	Dec. 26, 1909	Chelsea Street Bridge, East Boston . . . . .	F. P. Spalding.
15.20	Dec. 26, 1909	Deer Island . . . . .	S. R. Gauge.

*Low Tides.*

5.60	Nov. 27, 1898	Deer Island, Metropolitan sewer station . . . . .	Self-recording gauge.
—3.50	Feb. 1, 1900	Deer Island, Metropolitan sewer station . . . . .	Self-recording gauge.
—2.94	Feb. 3, 1900	South Boston station, Edison Electric . . . . .	D. A. Harrington.
—3.00	Feb. 4, 1904	Deer Island, Metropolitan sewer station . . . . .	Self-recording gauge.
—2.70	Mar. 23, 1905	Deer Island, Metropolitan sewer station . . . . .	Self-recording gauge.

## THE HIGH TIDE OF DECEMBER 26, 1909.

The morning tide of December 26, 1909, attending the severe storm of this date on the New England coast, was one of the highest ever recorded in Boston Harbor. At Boston Light the predicted time of high tide was 10.20 a. m. The wind from the late afternoon of the 25th until nearly noon of the 26th was from the east and northeast over Boston Harbor and Massachusetts bay, rapidly increasing in force during the evening of the 25th to very high velocities soon after midnight, which continued undiminished through the morning and day of the 26th. At Cape Cod, Highland Light, the velocity at 8 a. m. of the 26th was 48 miles north-east; noon, 72 miles; 2.15 p. m., 84 miles; at 5 p. m., 66 miles, all from the eastnortheast, and at midnight

it was 60 miles north. At Hull, Mass., the hourly movements on the 26th were as follows: Midnight to 1 a. m., 37 miles; 1 to 2 a. m., 43; 2 to 3 a. m., 46; 3 to 4 a. m., 63; 4 to 5 a. m., 58; 5 to 6 a. m., 60; 6 to 7 a. m., 56; 7 to 8 a. m., 60; 8 to 9 a. m., 54; 9 to 10 a. m., 65; 10 to 11 a. m., 55; 11 a. m. to noon, 48. During the afternoon the velocity ranged between 40 and 50 miles per hour. The maximum velocity at Hull was about 72 miles per hour at 9.35 a. m. At Boston the hourly movements from midnight to noon of the 26th ranged between 25 and 39 miles, the hourly maximum rates between 32 and 45 miles per hour, the latter occurring at 5.10 a. m. from the northeast. The increasing and high wind occurring with the rising tide, together with a high run of tide, caused the water in Boston Harbor to reach approximately the record height of the tide of April 16, 1851, which at the United States Navy Yard was 15 to 15.1 feet, the height of the tide of December 26, 1909, being, at the same station, 14.98 feet. In general, the tide in Boston Harbor and Massachusetts bay was approximately 3.5 feet above the predicted height. The actual height, as given by the United States Engineers and other reliable authorities at the following places, was as follows: Newburyport, Mass., Harbor, Black Rock Wharf, 12.68 feet; Sandy bay, Rockport Harbor, 13.64; Boston Harbor, Deer Island, 14.56; Plymouth Harbor, 14.8; Barnstable bay, 13.25; Provincetown Harbor, 14.35. The tide at all of these stations, with the exception of Plymouth and Barnstable, was approximately 5 feet above mean high water.

The high water caused great damage to water front and shore property in many places by the flooding of cellars and by washouts. The greatest damage occurred in portions of Chelsea and Everett, Mass., where the breaking of a dike permitted the tide to cover a large residential section to a depth of several feet, causing the death of two persons and temporarily driving several thousand persons from their homes.—J. W. Smith, District Forecaster. (Climatological Service of the Weather Bureau. Report for January, 1910.)

## APPENDIX D.

## ENGINEERING DEPARTMENT ANNUAL REPORTS, 1867-1909.

Number of Report.	For the Year.	Year Published and City Document Number.	Number of Report.	For the Year.	Year Published and City Document Number.
First.....	*1867	1868-22	Twenty-fourth.....	*1890	Executive Department Report, Document 1, Part 1, 1891.
Second and Third.....	1868-69	1870-14			1892-11
Fourth.....	1870	1871-15	Twenty-fifth.....	1891	1893-10
Fifth and Sixth.....	*1871-72	1873-23	Twenty-sixth.....	1892	1894-10
Seventh.....	*1873	1874-20	Twenty-seventh.....	1893	1895-10
Eighth.....	1874	1875-19	Twenty-eighth.....	1894	1896-10
Ninth.....	1875	1876-24	Twenty-ninth.....	1895	1897-10
Tenth.....	*1876	1877-15	Thirtieth.....	1896	1898-12
Eleventh.....	*1877	1878-20	Thirty-first.....	1897	1899-12
Twelfth.....	*1878	1879-22	Thirty-second.....	1898	1900-14
Thirteenth.....	*1879	1880-33	Thirty-third.....	1899	1901-14
Fourteenth.....	*1880	1881-25	Thirty-fourth.....	1900	1902-15
Fifteenth.....	1881	1882-52	Thirty-fifth.....	1901	1903-15
Sixteenth.....	1882	1883-53	Thirty-sixth.....	1902	1904-15
Seventeenth.....	*1883	1884-55	Thirty-seventh.....	1903	1905-15
Eighteenth.....	*1884	1885-54	Thirty-eighth.....	1904	1906-15
Nineteenth.....	*1885	1886-41	Thirty-ninth.....	1905	1907-17
Twentieth.....	*1886	1887-38	Fortieth.....	1906	1908-17
Twenty-first.....	*1887	1888-39	Forty-first.....	1907	1909-16
Special report.....	1888	1888-117	Forty-second.....	1908	1910-14
Twenty-second.....	1888	1889-38	Forty-third.....	1909	
Twenty-third.....	1889	1890-39			

\* Out of print.

## APPENDIX E.

(REVISED ORDINANCES, 1898, CHAPTER 16.)    ENGI-  
NEERING DEPARTMENT.

SECTION 1. The Engineering Department shall be under the charge of the City Engineer, who shall be consulted on all matters relating to public improvements of every kind in respect to which the advice of a civil engineer or architect would be of service; shall, unless otherwise specifically provided, take charge of the construction of all public works of the city which properly come under the direction of a civil engineer; shall make such surveys, plans, estimates, statements and descriptions, and take such levels and prepare such specifications and contracts as the mayor, the board of aldermen, the common council, any committee of the city council or of either branch thereof, the board of street commissioners, or any officer in charge of a department, may need in the discharge of its duties; shall, upon being notified by the superintendent of streets, supervise all repairs on the bridges of the city used as highways which affect the safety of the structures, and shall, when required by the mayor or any officer in charge of a department, measure the work done by contract for the city, and certify to the results of such measurement. Said engineer shall have the custody of all surveys and plans relating to the laying out, locating anew, altering, widening and grading of streets; and his office shall be deemed to be the office of the surveyor of highways.

SECT. 2. Said engineer shall, in his annual report, include a report upon the safety and completeness of all ponds, basins and reservoirs under the charge of the water department, and of all bridges within the city limits used as highways.

(Stat. 1870, chap. 337; Stat. 1895, chap. 449, par. 21.)

## APPENDIX F.

## MERIDIAN LINE.

In 1870 an act was passed by the Massachusetts Legislature requiring each land surveyor in the state at least once in every year to adjust and verify his compass by the meridian line established in the county wherein his surveys were to be made.

A meridian was marked by stone monuments and a book of record kept by a custodian designated by the County Commissioners.

The law compelling surveyors to test their compasses annually was modified in 1875, so that surveyors who did not use the compass in turning angles were relieved from the penalty attaching to the violation of the original act.

The meridian posts for the County of Suffolk were placed on the southerly portion of the "Parade Ground" on Boston Common. They are granite posts, three in number, placed 200 feet apart, are 18 inches square at the base, 1 foot square at the top, and 8 feet long, being firmly set in a bed of concrete with their tops originally just below the surface of the ground.

A stone curb was placed even with the surface of the ground over the top of each post, with a metallic composition cover.

The surface of that part of the Common where the posts are set was raised several feet in 1897, the posts being protected by building a brick manhole around each stone, the posts being accessible by the removal of the manhole cover.

As the cover and cap of the manholes are made of iron it is now necessary to set up the compass in the production of the line marked by the monument to avoid local attraction. The point selected has been 290 feet north of the northerly stone.

The following table gives the number of tests for each year, with the average readings:

YEAR.	Number of Readings.	Average of Readings West of North.	YEAR.	Number of Readings.	Average of Readings West of North.
1871.....	9	10-53-46	1890.....	7	11-39-56
1872.....	8	11-09-47	1891.....	4	11-49-30
1873.....	3	11-07-53	1892.....	—	
1874.....	3	11-11-40	1893.....	1	12-32-20
1875.....	3	10-58-33	1894.....	—	
1876.....	2	11-13-00	1895.....	—	
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## APPENDIX G.

## ATLANTIC AVENUE EXTENSION BRIDGE.

*History of Legislation and Official Action.*

The first legislation authorizing the construction of the South Union Station, which involved changes in the existing streets in the vicinity of the proposed station, was chapter 516, Acts of 1896, which was approved June 9, 1896.

This act provided for the widening and extension of Cove street to Summer street, no mention being made of the portion of old Cove street, between Kneeland and Furnace streets; this portion was not an accepted street, but most of the area was afterwards included in the extension of Atlantic avenue.

Section 11 of the above act provides that the Terminal Company which was incorporated to carry out the provisions of the Act,

“shall construct a bridge for the accommodation of foot passengers or a subway from the end of the new Cove street to meet Dorchester avenue at a convenient place, as determined by the Railroad Commissioners and Street Commissioners, sitting jointly, whenever said commissioners deem it necessary.”

On January 18, 1897, the Board of Aldermen passed an order:

“That the City Engineer be hereby requested to prepare plans and an estimate of the cost of a bridge 50 feet wide, with a 10-foot sidewalk on one side, from First street to Cove street, etc.”

The City Engineer, in answer to the above order, reported on February 1 that he had prepared a plan and estimate for a bridge, and that the estimated expense for a bridge 60 feet wide was \$389,169. On the same date the Board of Aldermen passed an order:

“That the Chairman of this Board petition the General Court at its present session for such legislation as may be necessary to enable the City of Boston to construct a bridge from Cove

street, City Proper, to a point near First street, South Boston, . . . said bridge to be 60 feet in width . . . ; also for authority to borrow, outside the debt limit, the sum of \$390,000 for the construction of said bridge substantially in accordance with plans prepared by the City Engineer of the City of Boston."

On February 18, 1897, the Common Council passed a resolve which the Board of Aldermen concurred in on February 20, approving of a proposed act of the Legislature to amend chapter 516 of the Acts of 1896, so as to provide for the extension of Cove street by a bridge over the tracks of the Terminal Company and Fort Point channel to old Dorchester avenue, and ordered that the Mayor be requested to appear before the Committee on Railroads of the General Court at their hearing on February 23, and advocate the passage of the aforesaid bill. At a later date it was stated in debate in the Common Council that the Mayor failed to appear in behalf of the bill and an attempt was made to have the City Engineer instructed to appear at a subsequent hearing and advocate the bill; this failed of concurrent action, as, in the meantime, the committee of the Legislature had reported recommending that the petitioner have leave to withdraw. The friends of the bill did not allow the matter to rest, however, and the result was that chapter 388 of the Acts of 1897 was passed and approved on May 11, 1897.

This last act repealed that portion of section 11 of chapter 516 of the Acts of 1896, which related to the construction of a footbridge or a subway from the end of Cove street to Dorchester avenue, and inserted the following:

"Cove street shall be extended by a bridge over the tracks of the Terminal Company and over Fort Point channel to Dorchester avenue at or near West First street in South Boston; and the said Terminal Company shall pay towards the cost of said bridge such sum as the Railroad Commissioners may determine to be equivalent to the cost of constructing for the accommodation of foot passengers a suitable bridge or a suitable subway from the end of the new Cove street, before its extension as herein provided, to meet Dorchester avenue at a convenient place: *provided, however,* that the extension of Cove street to West First street shall not be begun until such time after the first day of July in the year eighteen hundred and ninety-eight as may be determined by the Railroad Commissioners and the Street Commissioners sitting jointly,"



On June 27, 1898, the Citizens Association of South Boston petitioned the Street Commissioners to lay out the extension of Cove street and to fix a date for beginning the construction of the bridge, as provided for by chapter 388 of the Acts of 1897. This matter was taken up by the two commissions during the autumn of 1898.

On March 8, 1899, a hearing was given by the two commissions sitting jointly, for determining what action should be taken by these Boards under chapter 388 of the Acts of 1897. The Street Commissioners presented a plan, entitled "City of Boston, Cove Street Extension, City Proper, January 20, 1899, William Jackson, City Engineer," and it was determined that the time when the extension of Cove street, according to said plan, should be begun should be the tenth day of March, 1899.

On March 10, 1899, the Street Commissioners issued an order of notice of their intention to lay out an extension of Atlantic avenue, formerly Cove street, and appointed a hearing on March 24, 1899; on that date, after hearing several parties, including the representatives of the Boston Terminal Company, who protested against any action, the Board laid out the street in accordance with the plan dated January 20, 1899, above mentioned. An attempt was made to have the General Court of 1899 repeal the Act of 1897, but, instead, a new act was passed, being chapter 466 of the Acts of 1899, approved June 2, 1899. This act provides that "Atlantic avenue (formerly Cove street), in the City of Boston, as extended and laid out by the Street Commissioners of said city on the 24th of March in the year 1899, from Kneeland street over land and tracks of the Boston Terminal Company, and with a draw over Fort Point channel and lands of the Old Colony and New York, New Haven & Hartford Railroad Companies, to Dorchester avenue, at the width and with the grades and by the method of construction as shown by a plan deposited in the office of the City Engineer of said city, marked 'City of Boston, Cove Street Extension, City Proper, January 20, 1899, William Jackson, City Engineer,' shall, subject to the approval of the Board of Harbor and Land Commissioners in respect to structures in and over tide water, forthwith be constructed by the city, acting by its City Engineer, in accordance with said layout and plan, except as the same may be changed in details of construction by the City Engineer of Boston, with the consent of the

terminal company, and the action of the Street Commissioners in laying out and extending said Atlantic avenue is hereby ratified and confirmed."

Section 2 has the same provision as the previous act, for the payment by the terminal company of the estimated cost of a structure for the accommodation of foot passengers, and provides that the city shall pay the balance of the cost, and that the City Treasurer shall at the request of the Mayor issue bonds to the amount required.

A preliminary plan was accordingly prepared, dated June, 1899, for the portion of the bridge across Fort Point channel. This plan provided for a drawbridge of the "retractile" form; it was approved by the Harbor and Land Commissioners and submitted to the War Department. Under date of September 11, 1899, the Secretary of War informed the Mayor that

In view of the protests in this case and the reports of Colonel Suter and the Chief of Engineers, the plan for the proposed bridge will not be approved.

On September 21, 1899, the Common Council requested the City Engineer to prepare plans and specifications for a bridge to connect Atlantic avenue with Broadway without crossing tide water.

This last proposition did not prove popular and nothing further was done during 1899. Early in the year 1900 the matter was again taken up, and on February 12 the Board of Aldermen appointed a committee to consider the subject and attend a meeting before the Secretary of War for the purpose of having the matter of the disapproval of September 11, 1899, reconsidered. As a result, on July 10, 1900, the plan of June, 1899, was approved by the War Department.

On July 26 an order of the City Council was adopted requesting the Mayor to order the City Engineer to proceed with the construction of the bridge.

Plans and specifications were prepared for building the approaches to the bridge and work was begun on the northerly approach on March 6, 1901. Nothing was done during this year on that part of the bridge across the tracks owing to the failure of the city and the terminal company to agree upon the method of doing the work.

On January 31, 1902, an agreement was made between the Mayor and the terminal company as to the method

of carrying on the work of building the masonry piers between the railroad tracks. This agreement was ratified and confirmed by chapter 141 of the Acts of the General Court of 1902, approved March 4, 1902.

A new plan of the part of the bridge across tide water was prepared, which substituted a pivot draw for a retractile draw as required by the plan of June, 1899, and also provided for a channel of 50 feet in width instead of 42 feet as originally planned; this plan was dated March 12, 1902, and was approved by the Harbor and Land Commissioners on March 26, 1902, and by the War Department on April 18, 1902.

The work of building the masonry foundations for the bridge continued through 1902 and 1903, being practically completed in 1903.

Bids were received on July 2, 1903, for the erection of the steel work of the fixed portions of the bridge, the specifications leaving the matter of temporary occupancy of portions of the terminal company's grounds to be arranged by the contractor; the bidders, not being able to make such arrangements, made proposals which were rejected for informality.

On March 12, 1904, an agreement was made between the Mayor and the terminal company by which the city was given facilities for the erection of the steel work; this agreement was ratified and confirmed by chapter 266 of the Acts of the General Court of 1904, approved April 25, 1904.

On November 1, 1904, a contract was made for the erection of the steel work of the north approach and of all the fixed spans.

No further legal obstacles to the prosecution of the work were encountered and the construction progressed during 1905 and 1906 under several different contracts and was completed, except as to a few minor features, so that the bridge was opened to all travel on August 12, 1907.

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